ELECTRICAL REVIEW

THE PIONEER ELECTRICAL WEEKLY OF AMERICA

VOL. LI. No. 13 NEW YORK, SATURDAY, SEPTEMBER 28, 1907. ISSUED WEEKLY

CHARLES W. PRICE . . . . . PRESIDENT AND EDITOR
STEPHEN H. GODDARD . . . . . SECRETARY AND MANAGER
WM. HAND BROWNE, JR. . . . . TECHNICAL EDITOR
AINSLIE A. GRAY . . . . . MANAGING EDITOR

NEW YORK
PUBLISHING OFFICE . . . . . 13-21 PARK ROW

CHICAGO
WESTERN OFFICE . . . . . MANHATTAN BUILDING

BOSTON
NEW ENGLAND OFFICE . . . . . 95 MILK STREET

LONDON
EUROPEAN OFFICE, HENRY W. HALL, Manager, 42 OLD BROAD STREET, E. C.

TELEPHONE AND CABLE
TELEPHONE "21 Cortlandt." Private exchange to all Departments.
REGISTERED CABLE ADDRESS: "Electview," New York.

SUBSCRIPTIONS

One Year, United States	$3.00
One Year, Canada	4.00
One Year, Foreign Countries	6.00
Single Copy, 10 cents. Back numbers, beyond one month, each	.25

ADVERTISING

CHANGES for advertisements should be in this office by *Friday noon* for the following week's issue.

NEW ADVERTISEMENTS should be in the office not later than *Monday noon* to assure publication in that week's issue.

Published weekly by the ELECTRICAL REVIEW PUBLISHING COMPANY, 13 Park Row, New York. Charles W. Price, president and treasurer; Stephen H. Goddard, secretary.

Entered at the Post Office at New York as second-class matter under the Act of March 3, 1879.

CONTENTS

EDITORIAL:
- The Adaptability of Electric Power for Mining . . . 499
- Electrical Stimulation of Plants . . . 500
- Confidence in the Electric Motor . . . 501
- Electrical Anaesthesia . . . 501

Meeting of the Street Railway Association of the State of New York . . 502
Colorado Electric Light, Power and Railway Association . . . 504
The Electric Lighting and Illuminating Engineering Number of the ELECTRICAL REVIEW . . . 504
High-Tension Insulators, from an Engineering and Commercial Standpoint, by C. E. Delafield . . . 505
A New System of Wireless Telephony . . . 507
Power Plant for the Yukon . . . 507
A New Mine Plant in Germany, by B. F. Hirschauer . . . 508
Electric Mail Tubes for Italian Post-Office . . . 510
Electric Power in Copper Mines . . . 510
Flaming Arc Lamps Abroad . . . 511
Rejuvenated Sons of Jove . . . 514
An Improved Sleeping Car for Interurban Electric Railways . . . 514
Electrical Supplies for the Navy Department . . . 514
Water-Power Development in Norway . . . 514
Primary and Secondary Wattmeter Standards, by H. W. Young . . . 515
The Chicago Electrical Show . . . 517
Special Trains for the Street Railway Conventions . . . 517
Copper Mining in Jamaica . . . 517
Three-Wire Direct-Current Generators, by B. T. McCormick . . . 518
The Incandescent Lamp in Connection with Electric Signs, by Benjamin Wall . . . 519
The Electrical Show at Madison Square Garden . . . 520
A Proposed Code of Ethics for Electrical Engineers . . . 520
Lighting on a Moonlight Schedule . . . 521
Large Chilean Concession for Power Plant . . . 521
Annual Convention of the Empire State Gas and Electric Association . . 521
REVIEWS OF CURRENT ENGINEERING AND SCIENTIFIC LITERATURE . . . 522
INDUSTRIAL SECTION:
- The De La Vergne Kerosene Oil Engine . . . 524
- Jeffrey Mining Machines . . . 525
- Wireless Telegraphy in China . . . 525
- The "Fielding" Sectional Mica Plug and Receptacle . . . 526
- The Growth of the Trumbull Electric Manufacturing Company . . . 526
- Asbestos Wood . . . 527
- A New Insulating Varnish . . . 527
- The New "American" Portable Relay . . . 527

Amalgamated Copper Subsidiaries Cut Copper Output Fifty Per Cent . . 528
Consolidation of Chicago Edison Company and Commonwealth Electric Company . . . 528
City of St. Charles, Mo., Wants Electric Street Car System . . . 528
Chicago to Adopt Nickel-in-the-Slot Cars . . . 528
The Fall Meeting of the American Electrochemical Society . . . 528
CURRENT ELECTRICAL NEWS . . . 529
RECORD OF ELECTRICAL PATENTS . . . 536

Copyright, 1907, by Electrical Review Publishing Co.

THE ADAPTABILITY OF ELECTRIC POWER FOR MINING.

An instructive example of the adaptability of electric power for mining purposes is that described by Mr. B. F. Hirschauer on another page of this issue. The particular installation referred to in this article is that at the Thiederhall mines, near Brunswick, Germany. Here there is a dead shaft, some 600 feet long, which ends in a gallery running to the shaft which reaches to the surface of the ground. There is thus not a clear lift from the workings in the mine to the surface of the ground, so that it became necessary to install a hoisting plant underground at the head of the lower shaft, which is nearly 1,000 feet below the surface. Power for working the hoisting apparatus must, of course, be supplied from the surface of the ground.

Formerly a compressed-air equipment was utilized for this purpose, but for various reasons this was taken out and the present electrical equipment installed in its place. The advantages leading to this transformation are: the better efficiency of electrical transmissions over such distances as are here involved, the better efficiency of electric motors as compared with compressed-air motors, and the better load-factor obtainable in the electric generating plant. The transformation was thus brought about primarily to effect economy of operation, though for the peculiar conditions at this mine the electric system seems to have some very desirable advantages. For example, not only is the electric motor better adapted to driving hoisting apparatus when it requires a rotary motion, but it is more easily controlled, automatic safety devices are more readily applied, and it becomes possible to save part of the energy which would be lost in braking a descending car by means of a storage battery. Moreover, the adoption of electric power simplifies the mine equipment, since it thus becomes possible to supply the hoisting power and the lighting current from one plant.

It is interesting to point out the way in which economy has been obtained in the operation of this mine. Hoisting work is always irregular, and unless special arrangements be adopted the load-factor at the generating station will be poor. In this case, by the installation of a storage battery and proper regulating devices, the load of the generator is rendered practically uniform, and the size of the battery in this case is made large enough to supply the heavy current demanded at starting and to operate the winding motors when the generator is shut down. Thus, although the generator in this plant is rated at only sixty kilowatts, the two motors driving the hoisting machine are rated at 300 horse-power. The average load during the hoist

is, of course, considerably less than this, but it is necessary to have motors of this rating in order to start the cage promptly. Moreover, the generator is helped out in this work by the power returned to the batteries during the descent of the cage.

This feature of the plant which equalizes the load of the generator by means of the storage battery is particularly interesting because so much has been heard of another method which has apparently been applied with much success. In the latter, a heavy flywheel mounted upon a special motor-generator is utilized for storing up energy and delivering it at times when there is an excessive demand. This particular equipment is especially suited for work for installations where power is secured from a distance, but the system could be applied to any local generating plant, provided, of course, care was taken to provide the necessary constancy of potential for the lighting system. It is rather noteworthy that, although the use of electric power in mines is rapidly extending in this country, there are but few installations in which either of these means of maintaining a high load-factor has been thought necessary.

ELECTRICAL STIMULATION OF PLANTS.

An interesting contribution to the study of the effect of electricity upon plants is contained in a paper presented recently before the British Naturalists' Society by Mr. J. H. Priestly. This paper gives, first, a brief historical review of the preceding experiments in this field of investigation, and then a more detailed description of several experimental installations which have been in operation during the past three years. The historical part of the paper describes the various methods which have been tried for stimulating plant growth, those in which the current is passed through the ground and those in which the stimulation was by means of silent discharges and attempts to maintain the plant at a potential above that of surrounding bodies. The experiments described deal, however, with but one method; that in which it was sought to stimulate the plants by means of brush discharges from points suspended above them.

The experimental work was carried out at various points by Mr. J. E. Newman. During 1905 he tried the method at Bitton, near Bristol, and at Gloucester. During 1906 an experiment was made at Bevington Hall, Evesham. At Bitton a large open space and fifteen glass houses were given up to the test, seven of the latter and about half the uncovered ground being equipped with the electrifying system, the rest being retained for control tests. The total area is about 1,000 square yards. In those plots where electrification was to be tried wires were carried sixteen inches above the tops of the plants and fitted at intervals with discharge points turned downward. These systems of wires were charged by means of a Wimshurst machine driven by an oil engine. The wires were supported by means of ordinary telegraph insulators which proved satisfactory, except during very wet weather. This machine was kept in operation about nine hours daily from March 7 until May 20. Thereafter it was run mainly at night, about the same length of time. The results of the experiment generally show an increase as compared with the untreated crops, but in other cases there was a decrease. For example, cucumbers increased seventeen per cent, strawberries thirty-six per cent for old plants, and eighty per cent for new plants. Certain crops while showing not so great an increase were ready for picking a week or more earlier. Beans showed a decrease in production but were ready for picking five days earlier. Some plants seemed to be unaffected. In one case a disease of a bacterial nature appeared, but made less progress on those plants which were electrified.

A somewhat similar installation was tried over a vegetable crop at Gloucester. The wires here were placed five feet above the ground and a higher voltage was maintained by means of an influence machine. Beets, carrots and turnips showed a varying increase, in one case this being fifty per cent. It is noteworthy that not only the beets showed an increase of one-third compared with the untreated plants, but the percentage of sugar was 8.8, while that of the unelectrified plants was only 7.7. This result contains a hint that we may in future devise ways of controlling crops so as to give them that particular characteristic which is being sought. In this instance sugar and not beet root is what is wanted; and an increase of over fourteen per cent in the sugar content is well worth striving for.

The experiments at Evesham were even more elaborate, for here forty acres were available for the work. Over half of these, wires were stretched about fifteen feet from the gound on poles in rows about 100 yards apart. Telegraph wire was carried down these rows and thin galvanized iron wire stretched twelve yards apart from row to row. The crops planted on these plots were wheat, barley, potatoes and other vegetables. The unelectrified ground was planted in much the same way. The electrification here could not be started until late in the spring, due to a delay in delivering the apparatus. The system was completed about the end of May and operated until July 10. The results showed that there was an increase of about thirty-nine per cent in the wheat crop on the electrified area, and moreover, this wheat contained ten per cent more gluten than the other. These results are not considered conclusive, and this year the experiment has been repeated. The results obtained from the treatment of the other crops has not yet been determined.

As Mr. Priestly points out, no definite conclusions can be drawn as yet, because of the few data yet available. The experiments must be continued, and it is very desirable, of course, that they be conducted on the scale which has here been tried. At the present time this work must be largely empirical, particularly in outdoor work, since other conditions are not yet under entire control and naturally, when such methods are followed the work is long and laborious. It seems likely that the method which is being tried by Mr. B. H. Thwaite, reference to which was made in the ELECTRICAL REVIEW, August 24, will give more immediate results, as his plan contemplates controlling all conditions

There is one feature of this work which handicaps experiments greatly. This is our ignorance of the effect of the current. It is not known whether it acts physiologically by actual stimulation, or chemically by modifying the contents of the earth or the air. Brush discharges produce ozone and some times oxides of nitrogen, and it may be that the increase in production is due to these substances, the real effect being secondary. Moreover, a current passing through the earth may act directly by stimulating the roots; it may act electrolytically, for, since the earth is not a uniform electrolyte, chemical action may take place at various points; or it may produce endosmose, and thus draw to the plants moisture which they would not otherwise obtain. It is very desirable that the effects of these various actions be separated and this could be done on a comparatively small scale so as to bring the conditions under better control. Only in this way will we arrive at the true understanding of the electrical action, and be able to determine whether or not it is worth while. Here seems to be an excellent field for amateur investigation. The experiments need not be expensive, but the work should be done with the greatest care and calls for patience and accurate observation. It is not improbable that some very valuable information could be obtained in this way.

CONFIDENCE IN THE ELECTRIC MOTOR.

A few years ago electrical engineers used to express their surprise and disappointment at the slowness with which other branches of the profession were utilizing the advantages of the electric motor. The former, through constant work with the motor, had learned to appreciate its characteristics and had gained confidence in its capabilities, and they could not understand why others did not share this confidence. There was some justice in this feeling of disappointment; but on the other hand, one could not much blame an engineer who had had no experience with electric motors for not having the same confidence in their reliability as he had in the steam engine after 100 years of development. It naturally happens that when a new device is installed a man familiar with it is usually put in charge, and other engineers connected with the work are more likely to hear of the accidents or failures than of the successes in working. One minor breakdown of a new appliance will often offset a whole month of successful operation.

It may be safely said that now, at least, the electric motor has demonstrated its reliability. No one to-day questions this and undoubtedly it is one of the many reasons why within recent years the use of the motor has spread so rapidly. No one can say to-day that he would be glad to make use of the motor because of the advantages which it possesses, but that he is afraid to trust it; that he would rather stick to an older though inferior machine because he knows that he can depend upon it at all times.

This reliability of the electric motor is, of course, due to improved design and has been a matter of growth. It may seem to some that it has taken a long time to produce a really mechanical motor, but relatively this is not true, for we have had excellent apparatus for many years past—machines that were thoroughly dependable. Moreover, it should be remembered that the electric motor is really a comparatively young machine. With any new device years of actual experience are required for sorting out all the weak points and demonstrating the most satisfactory method of meeting all of the many and various conditions under which it may be called upon to work. The result has been the production of a machine, the design of which, so far as its electrical properties go, is truly scientific and which, mechanically, is able to meet those conditions for which experience has shown provision must be made.

ELECTRICAL ANÆSTHESIA.

A cable dispatch to the New York *Times* from Paris announces that Dr. Stephane LeDuc, Professor of the School of Medicine at Nantes, has discovered a method of causing sleep, which, it is declared, will replace chloroform and other anæsthetics in surgical operations. The advantage of the new system, it is said, is that it is always under perfect control and there is no disagreeable after-effect, because no drugs or other materials are introduced into the system. The method of application is not clearly explained, but it is said to be the application of an intermittent electrical current to the head. Dr. LeDuc has experimented with this system on animals and upon himself, and believes that he has made an important contribution to medical science.

Further reports on the new system will be awaited with interest. It is well known that an electrical current, if passed through the body, may act directly on the nerves, and it is very probable that this may be done by a method which will produce anæsthesia. Such currents passing through the head may have other effects, so that the new system should be applied with all caution. If no serious consequences are found, the method will no doubt be given a high place in surgical operations; yet there is always a danger that it may be abused. Dr. LeDuc himself says that he can produce death painlessly, and although it is not said directly, he probably does this by a modification of his method. There are always incompetents and quacks eager to seize on every new medical advance, which they use upon the credulous to their own profit, and although it is entirely legitimate to make every good use of electrical effects for relieving suffering, it must never be forgotten that the action of electrical current upon the human organism is not fully understood, and every precaution must be taken to see that no unexpected effect creeps in. There is no doubt that there is a great field for surgical advance by means of electrical effects, yet the advance must always be made with the greatest of care. The very peculiarities of the electrical current which seem to be the most beneficial may indeed be the most dangerous. There is, therefore, need for careful experimentation and research by the most competent physicians. The possibilities are great, though the responsibilities are not less. Hence ill-timed and injudicious announcements should be most carefully guarded against.

MEETING OF THE STREET RAILWAY ASSOCIATION OF THE STATE OF NEW YORK.

QUARTERLY MEETING, HELD AT KINGSTON, N. Y., SEPTEMBER 21.

The regular quarterly meeting of the Street Railway Association of the State of New York was held at Kingston Point Park Pavilion, Kingston, N. Y., September 21. President T. W. Wilson called the meeting to order at 10.15 A. M. The registration showed a large number of representative street-railway men in attendance.

The first order of business was the report of the Committee on Interurban Rules. This report was presented by J. E. Duffy, of Syracuse, chairman. The committee considers that inasmuch as many of the interurban railways have adopted a number of the rules contained in the standard code of the American Railway Association, and it has been found that this code serves the purpose of the electric railways very satisfactorily, that the Street Railway Association of the State of New York might do well to adopt such code, making such alterations as may be necessary to fit the conditions.

The meeting proceeded to consider the report of the committee in detail. Certain minor changes in phraseology were made in the rules relating to the conduct and discipline of employés while on duty, their methods of reporting accidents, etc.; and in connection with the definition of "train—an engine or more than one engine, or a motor or more than one motor, coupled with or without cars, displaying markers," as proposed by the committee.

Taking up the latter topic, I. H. McEwen remarked that his understanding of the word "engine" was "a locomotive propelled by any form of energy." He inquired if that was the definition which the committee was using.

After considerable discussion, Mr. Duffy said that the committee would accept the definition as put by Mr. McEwen.

With reference to the definition of "time-table," there was some little discussion, the committee's definition finally being adopted.

In connection with the definition "yard motor or engine," which the committee gave as "a motor or engine assigned to yard service and working within yard limits," Mr. Duffy stated that as the committee had accepted the classification as provided for "engine," he saw no use in repeating the word "motor."

Mr. McEwen thought that the object of making the amendment was to avoid repetition.

E. S. Fassett thought that the rules under consideration were intended for employés who were used to running motors, calling them motors, and not calling them engines or locomotives or anything of that kind. He thought the distinction should stand as it was, "yard motor or engine."

C. R. Barnes agreed with Mr. Fassett. On electric railroads, as they are operated in New York state, there are two classes of motive power, known to the general employé as the electric locomotive, and, in some cases, the steam locomotive. The motor-car is entirely distinct from these two in the minds of the motormen.

President Wilson stated that he believed that the committee should use names and terms that are familiar to the men operating the cars. On his system they were using the word "motor," not "engine."

S. S. Bradley thought it was wrong to make rules which would be subject to two or three interpretations. On the Seattle-Tacoma road he operated with electric locomotives, motor-cars and steam engines. These made up three distinct types of equipment. The service was operated on one track. He had adopted the rules used in the standard American classification, and was using these three definitions. He emphasized the point that it was wrong to put in anything in the rules that the employés could misinterpret.

C. Loomis Allen finally moved that the word "engine" comprise everything operated by electric and interurban railroads, regardless of type or power. With regard to the definition, "yard motor or engine," he suggested that the word "motor" be stricken out, because the question of the type of motive power had nothing whatever to do with the definitions used in train movement. This motion was not carried, the definition remaining as presented by the committee.

Under the head of "visible signals," sections B and C being left blank, and on the question of filling in the colors, Mr. Duffy remarked that white is ordinarily used for "proceed," and green for "proceed with caution." In view of a change in practice in this respect, the blanks had been left to be filled in by the association. To bring the matter to a vote, Mr. Duffy suggested that green be inserted for "proceed," and yellow for "proceed with caution," making the combination of lights red for "stop," green for "proceed," and yellow for "proceed with caution." This motion was adopted.

Under the discussion on "audible signals," Mr. Barnes thought that in the practical operation of electric railroads to-day, this matter was very important. Nothing should be done that would confuse the motorman as to what kind of trains he should signal. The rule as suggested by the committee included all classes of trains.

John H. Cain remarked that the rule under consideration particularly referred to trains of the same or inferior class or inferior right, and it could be seen that a second-class train carrying signals should not give signals to a first-class train, as a first-class train does not recognize a second-class train unless they have train orders.

Mr. Barnes replied that he did not know, with but one exception, of a road operating at the present time two classes of trains. That was the reason why he was convinced that any signals carried indicating a train following, or indicating another section following, should be called to the attention of all cars passed.

On motion of E. F. Peck it was voted that the rules under "audible signals" be adopted.

In connection with the section on "bell cord signals," Mr. McEwen thought that it would be a good idea to substitute the steam practice of three gongs, which indicates "when train is standing, back the train," for the electric practice of four gongs for the same indication.

Mr. Duffy stated that the standard practice of all city companies is to use four gongs to back the train or car; that most of the rules on the interurban roads were taken from the city rules, and that was the reason why it was so presented in the report.

Mr. McEwen replied that it made a distinction between the steam practice and the electric practice.

Mr. Fassett remarked that there was one more signal in the electric code—that is, two gongs, "when train is running do not stop for passengers," that is, in city service.

Mr. Duffy remarked that he did not like this rule in city service.

Mr. Fassett, however, said he did not care to have this rule added.

Mr. Bradley remarked that the signal, one bell, "stop at the next station," in practice does not work out well on interurban roads, particularly on the roads operating more than one car and using

the ordinary signal in the motorman's cab.

Mr. Allen inquired what was to be done where a steam road operates under one type of signals, and the electric road operates under another type. He moved that in order to bring the matter to a vote the indicating signals as outlined by the committee in Rule 16, page 22, of the Code of the American Railway Association be substituted for the report of the committee.

Mr. Barnes said he did not believe it was advisable for the street railways to stick too closely to steam railroad practice in adopting the rules; that the electric railways had to take the conditions as they existed to-day on the electric roads and provide rules for these conditions. The conditions existing on electric roads are in many cases different from those existing on steam railroads.

The motion was finally lost by a vote of fifteen opposed to eleven in favor, and the "bell-cord signals," stands as follows:

Conductor to motorman—two bells, "when train is standing, start"; one bell, "when train is running, stop at next station"; four bells, "when train is standing, back the train"; three bells, "when train is running, stop at once—emergency"; three bells, "when train is standing, apply or release air-brakes"; four bells, "when train is running, reduce speed"; five bells, "when train is standing, call in flagman"; five bells, "when train is running, increase speed."

Motorman to conductor—one bell, "come to cab"; two bells, "watch trolley"; five bells, "pull trolley down to roof"; four taps by the motorman is signal to conductor that he wishes to back train and is answered by conductor before train is backed.

In connection with section 20, under "train signals," which provides that all sections except the last shall display two green flags, and, in addition, two green lights by night in the places provided for that purpose on the front of the motor, Mr. Ryon remarked that the American Railway Association Committee on Rules last year changed the rule of carrying a green flag on the rear end of the train to a red flag. He asked, in the event of a trolley car running as a unit carrying green flags on the front end to denote a section following, and green flags on the rear end to denote the rear of the train, if the train is standing on a single track with the trolley pole down, which is the rear end of the car indicated by the green flag? Was there any way to determine the rear end if it had green flags on both ends?

W. R. W. Griffin remarked that the Rochester & Eastern Railroad overcome this by the addition to the regular electric headlight of a small white bull's-eye headlight alongside of it. This road had made its rules purposely to overcome this very difficulty. The end on which the bull's-eye is placed is the front end.

Mr. McEwen said that he would like to impress upon those present the importance from a train-dispatching point of view, and from the point of view of safety, of carrying green flags in addition to the two green lights at night. It was merely to cover the period between dusk and dawn. Although signal lights might have been put up at night, they might not be noticeable in the early dawn, and the use of both the flags and signals is a safety provision.

In connection with section 22, reading, "when two or more motors are coupled, the leading motor only shall display the signals, as prescribed by rules 20 and 21," Mr. McEwen offered an amendment to the effect that "both engines shall display the signals." His reason was that if the engines come to a station and one goes around behind the water tank to do switching, and a train comes through that is inferior to the first train, seeing the remaining engine standing coupled to the train without classification signals it is apt to think that there is no following section.

Mr. Duffy asked whether it would not be as well to leave the rule as it stood, and to allow any representative to add a section, 22A, if it was desired to incorporate such a rule.

Upon request, Mr. McEwen stated his motion as follows: "that the committee's recommendation for rule 22 should read, 'when two or more motors are coupled, each engine shall display the signals, as prescribed by rules 20 and 21.'" This motion, however, was not adopted.

On motion of Mr. Allen, the rule under section 91, reading, "unless some form of block signal is used, trains in the same direction must keep at least apart, except in closing up at stations," was stricken out.

The meeting then took a recess and reconvened at 2.15 o'clock, luncheon having been served at the pavilion.

In connection with rule 99, reading, "when a train stops or is delayed under circumstances in which it may be overtaken by another train, the flagman must go back immediately with stop signals to a sufficient distance to insure full protection; when recalled, he may return to his train, first placing two torpedoes on the rail when the conditions require it," Julian De Bois remarked that there was no specific distance stated.

Mr. Duffy replied that the road would have to depend upon the judgment of the flagman. Under some circumstances 150 feet would be enough, and under other circumstances, 1,000 feet would not be enough.

In connection with paragraph 102, "messages or orders respecting movement of trains or the conditions of track of bridges must be in writing," Mr. Barnes said that it was a question whether that was specific enough to show that the orders must be written by the train dispatcher and also written by the train crews receiving them.

M. Sheehan said that this matter was given further consideration later on in the report.

In connection with paragraph 206, regarding the designation of trains in train orders by their numbers, Mr. McEwen stated that it would be a good idea for all train numbers to be spelled out.

In connection with this a motion was carried to have the sentence read, "other numbers and time will be stated in figures and words."

After discussion the committee stated that paragraph 208-B of the rules of the American Railway Association would be added to its report. This rule concerns the sending of train orders to two or more offices simultaneously.

After discussion of the rules, the motion was adopted that the committee be continued to report further at a subsequent meeting and take into consideration the changes and suggestions made.

The motion was then carried to adopt the rules presented by the committee as a standard code for interurban service.

A paper entitled "Collection and Registration of Interurban Fares," was read by B. A. Frankel.

Mr. Frankel considers that the collection and registration of interurban fares is one feature of the railway business in which local surroundings and conditions must take a prominent part. His system, the Utica & Mohawk Valley Railroad, has gone through the experimental stages, having used several different systems of collection. At the present time there is being used the "tear-off cash fare receipt" on one division, and the duplex on another, both of which are working out with a fair degree of success. Mr.

Frankel considers the cost of installing ticket offices as money well spent, and thinks it a good idea to charge a slight excess fare over the ticket fare when the passenger pays on the car. He thinks it advisable to commence the use of tickets on the day the new line or division is opened for business. Should the public once get into the habit of paying its fare on the car, it would take a long time to give it up, unless the inducement of buying tickets was enough to pay it for the trouble. On the West Shore road the duplex system of collection has been very successful, because of the large sales of tickets. The excess fare is from five to ten cents on single trips, depending on the distance; and from five to thirty cents on round-trip tickets. The more simply the ticket is printed, the better the passenger likes it. The road makes no conditions, simply stating that it is good when properly stamped, and placing no time limit on the use. It has been his company's aim to lessen the work of the conductor as much as possible. For the convenience of the conductor on the heavy carrying sections of the Utica & Mohawk Valley, he registers all five-cent fares, giving no receipt whatever. For all cash fares above this amount, a receipt is given.

On the opening of the electrified portion of the West Shore Railroad, the experiment was tried of making but one collection for a through rider, instead of the usual practice of collecting in sections. A number of favorable comments on the part of the passengers have been made.

Following the discussion on this paper, Frank Walsh read a paper entitled "Freight and Express Rates."

Mr. Walsh considers that low-class freights do not pay for the trouble of handling, and with the prompt service that electric lines are able to give on local freight, they should look for high-class commodities. He finds that in most cases the electric road gets all that the steam road asks for. The matter of delivering freight and express is an important one. His company at one time hired wagons to do its collecting and delivering on a percentage basis, but after trying this for several months, found it did not work satisfactorily, and finally put in its own wagon equipment. After this its business increased. The Schenectady Railway Company's business is classified as follows: Class A, express service, including collection and delivery; class B, freight, no wagon service; class C, fast freight, wagon service on one end. Under class A goods are handled at a flat rate. This class is given preference in loading and delivering. Class B rate is applied on all shipments that are delivered at the company's terminals and called for at the destination by the consignees. Class C includes wagon service on one end (as a general thing, the delivery), and is applied mostly on shipments from wholesale houses to stores in various places. It is found that this class is a popular one with big shippers.

J. H. Pardee thought that one of the principal reasons why freight and express business had not been profitable for electric roads was because of the low classification. The electric railroad was attempting to carry freight with an electric car investment of about $10,000, equipped with two men, in competition with steam roads hauling freight on cars costing about $1,000 each and operating about forty cars in a train with four men.

Following the discussion on this paper, a motion was carried to appoint a committee consisting of five men, three members representing the express and freight department, one from the accounting department, and one general manager.

Before adjournment, a motion of thanks was passed to C. Gordon Reel and his associates of the Kingston Street Railway Company for the very successful and elaborate preparations which had been made to entertain the delegates to the convention.

COLORADO ELECTRIC LIGHT, POWER AND RAILWAY ASSOCIATION.

ANNUAL MEETING, DENVER, COLO., SEPTEMBER 18, 19 AND 20.

Evidence that Denver is regarded as the centre of the electric power industry in the West, was brought out in the fifth annual meeting of the Colorado Electric Light, Power and Railway Association in the convention hall of the Savoy Hotel on the morning of September 18, when the question of admitting North Dakota, South Dakota and Montana to the association came up for discussion. Though originally a Colorado organization, the field of the association has spread until it now lists in its roll call companies doing business in New Mexico, Arizona, Nevada, Utah and Wyoming. About 100 delegates were present when President George B. Tripp called the convention to order.

The morning session was short. The delegates did not get together until after 11 o'clock, and most of the time was consumed in the appointing of committees, presenting of credentials and the other usual routine business.

The following papers were read and discussed:

"Business Building by Commercial Departments," by George E. Putnam; "Incandescent Lamp Outlook," by Francis W. Willcox, of Harrison, N. J.; "High Tension Porcelain Insulators," by Frank E. Johnson, of Denver; "Central Station Power Problems," by Charles Robbins, of Pittsburg; "Lightning Protection in Colorado," by Leonard Wilson, of Denver; "Notes on Modern Boilers," by B. E. Buttles, of Denver.

Among the social features arranged for the convention were the following:

Wednesday evening, theatre party at the Broadway; Thursday afternoon, visit to the Northern Colorado Power Company's plant at Lafayette, and automobile ride for ladies; Friday afternoon, visit to the plants of the Denver Gas and Electric Company and the Denver City Tramway Company; Friday night, session of the Sons of Jove.

The following officers were elected for 1907-1908:

President — W. G. Matthews, City Tramway Company, Denver.

Vice-President—C. K. Durbin, United States Light and Traction Company, Denver.

Secretary and treasurer—J. F. Dostal, Denver Gas and Electric Company, Denver.

Executive committee—George B. Tripp, Colorado Springs; W. T. Wallace, Canon City, Colo.

Advisory committee—J. A. Beeler, Denver; W. J. Barker, Denver; J. F. Vail, Pueblo; Irving Hall, Denver; J. J. Cooper, Denver.

Membership committee—L. M. Cargo, Denver; E. P. Dillon, Colorado Springs; B. K. Sweeney, Denver.

Finance committee—V. A. Sickman, Denver; W. E. Robertson, Leadville; George H. Maxam, Green River, Wyo.

The Electric Lighting and Illuminating Engineering Number of the Electrical Review.

So great has been the demand for the special Electric Lighting and Illuminating Engineering Number of the ELECTRICAL REVIEW, published September 14, that the edition has been entirely exhausted. The publishers regret that a large number of orders can not be filled. Although a great many copies in excess of the regular edition were printed, the demand for the number has exceeded all expectations.

HIGH-TENSION INSULATORS, FROM AN ENGINEERING AND COMMERCIAL STANDPOINT.[1]

BY C. E. DELAFIELD.

The science of properly and safely insulating line voltages of high potential has not kept pace with the demands of transmission engineers, and to-day we are face to face with the problem of successfully transmitting potentials in excess of 100,000 volts. In California power is transmitted at 60,000 volts more than 200 miles, but great line losses are suffered and the investment in copper is heavy. An increase in voltage from 60,000 to 150,000 would make it possible to deliver this power with reasonable losses and in much greater quantity. As an illustration of the possibilities of delivering power at 150,000 volts, it would be possible to deliver the power generated at Niagara Falls economically to Boston, New York or Philadelphia, and, apparently, the principal hindrance to this consummation at the present time is in the fact that there is not on the market what might be termed a successful insulator for this enormous voltage, although the merits of a number of different types of insulators are at the present time being advocated for this purpose.

The design of an insulator for high voltages—quoting the words of Gerry—should involve a consideration of all of the effects of electrical tension on the dielectrics in the vicinity of the conductors. In the case of a line insulator, air is always a dielectric in combination with wood, porcelain, glass or other materials, and, wherever there is a difference of electrical potential, there exists in the surrounding media a certain state of strain called an electrostatic field. This state of strain is the result of electrical stress applied to the insulating material. It frequently happens, when several dielectric materials are subjected to the same electrostatic field, that one or more of the materials will be strained beyond the limit and fail, although the others will stand the electrical tension. Air adjacent to powerful dielectrics frequently fails in this manner, thus giving rise to the well-known brush discharge. The structural failure of air from an engineering standpoint has been studied by a number of investigators, including Dr. C. P. Steinmetz, Dr. F. A. C. Perrine, Professor Harris J. Ryan, M. H. Gerry and others, and, as the result of their published investigations, it is well known that air at the ordinary pressures and temperatures has a much lower dielectric value and strength than the common insulating materials. Air in thin films, adjacent to solid bodies, has greater strength than in bulk and is still inferior to such substances as glass and porcelain. The dielectric strength of air is affected by its physical condition and varies directly as the pressure and inversely as the absolute temperature. Under uniform conditions dielectrics rupture at definite applied tensions, Professor Ryan having shown that there exists for each dielectric material a certain strength of electrostatic field, which will cause a rupture. These being the fundamental rules by which designing engineers formulate their plans for the manufacture of insulators for varying potentials, it can well be seen that the various forms of insulators on the market to-day are the results of working out these rules by different individuals looking at the same thing from a different standpoint. That is to say, climatic and geographical conditions exert considerable influence in the design of an insulator. Insulators suitable for dry atmospheric conditions would not be suitable for a condition where sea fogs and dust exist, and there is no question but what a correct solution will soon be forthcoming for a standard insulator for voltages of 75,000 and upward. In fact, as noted before, the different manufacturers are now experimenting toward that end.

Looking over the history of high-tension transmission, it is only about fifteen years since we looked with wonder on the Lauffen transmission line of 30,000 volts over 100 miles. To-day there are thousands of miles of long-distance transmission at voltages ranging from 11,000 to 65,000 volts, and great credit is due the engineers who have designed and carried out this work in the face of almost insurmountable obstacles. The progress of high-tension transmission has been very rapid, and in all of the various branches, with the exception of the line insulators, it is now possible to handle voltages in excess of 75,000 volts, there being no difficulty whatever in the designing and manufacturing of successful transformers and switchboard apparatus for these high potentials. It should be taken into consideration, in the future designing and laying out of transmission lines—the possibility of increasing the present voltage to the voltage that may be possible a year or more from now, so that large quantities of power may be economically distributed over long distances.

It has been demonstrated by practice that very large generating units can be successfully operated and that both steam turbine and hydroelectric plants can be operated successfully, and the one question to be decided is, how can large powers that are so successfully generated be distributed over long distances economically, taking into consideration the high price of copper and aluminum. The answer to this question is, by high voltages only. Up to the present time the commonly accepted form of insulator is what is known as the pin type, meaning by that an insulator having for its resting place a pin imbedded in, or fastened to, a cross-arm; this pin being of wood or metal. Present practice has demonstrated that wood can be safely accepted for insulator pins up to 25,000 or 30,000 volts. Beyond that it is advisable, for mechanical reasons, to use malleable iron, but the so-called pin type of insulator has reached such dimensions, in the endeavor to meet the requirements for higher voltages, that it seems to be the consensus of opinion of the leading high-tension engineers that this type of insulator has reached the limit of good line construction, and, when one stops to think of the dimensions of an insulator used on a 60,000-volt transmission, one is inclined to think that the engineers are correct. Not only is it a difficult matter, from a mechanical standpoint, to find a pin that will take the necessary stress incident to an insulator of this large size and weight, but the problem of manufacture, from the standpoint of the pottery, is one that is exceedingly difficult, so that apparently it is necessary to make a radical departure from the present practice of pin insulation in order to take care of the various difficulties that are encountered in the construction of insulators for the higher voltages, and it is the belief of the writer, and also of other engineers, that a suspended form of insulator will be the type which will be used, it being from a mechanical standpoint a comparatively simple matter to suspend any desired weight, and from an electrical standpoint, it seems possible to so design an insulator that it will be mechanically strong and a good dielectric as well.

The suspended type of insulator would have the advantage that ample arcing distance could be provided without making the insulator top-heavy and difficult to manufacture. It should be so designed that arcing can not occur until the voltage is sufficient to rupture the air and

[1] A paper read at the annual convention of the Canadian Electrical Association, Montreal, September 11, 12 and 13.

cause the current to arc from end to end, this feature being of great importance where the insulators are mounted on steel towers, which is conceded to be the best engineering practice. On high voltage lines where steel towers are used the pin type of insulator for 100,000 volts, or higher, would seemingly be almost an impossibility, owing to the size necessary to take care of the surges and other line disturbances and owing to the fact that the earth potential is carried into the head of the insulator by the steel pin and through the metal towers.

An ideal insulator, for all conditions of high-voltage stress, should be one that would take care of climatic conditions, such as fogs, dust deposits, salt spray, etc., and should have as few still air spaces as possible. That is to say, it should expose a large part of its surface to the wind and should have a long leakage distance of small area. In the designing of a type of porcelain insulator for this class of work, it should be borne in mind that cemented parts, if there are any, should be under compression and not under tension, owing to the strains to which it may be subjected to from expansion and contraction. There should be as few still air spaces as possible to avoid the accumulation of dust, insects, etc., and there should be nothing but porcelain, well vitrified, between the points of opposite potential. Engineers are now at work along these lines, and, as the result, a number of plans have been proposed embodying more or less of these ideas, and it is only a question of a short time before the successful insulator will be evolved for these higher tensions; if it has not already come to pass.

Leaving for the time being the open question of extraordinary potentials, we will take up the question of high-tension transmissions as it exists to-day. Continuous operation of a transmission system is an absolute essential and depends to a large extent on the effectiveness of the insulator used. In this paper the writer only aims to discuss the qualities of porcelain insulators, as it is now generally conceded that porcelain is superior to glass for the manufacture of high-tension insulators, and, in fact, supersedes glass wherever the question of cost is not a paramount problem. In the designing of an insulator for any given voltage, and especially for the higher voltages, there are three considerations of primary importance: First, electrical design; second, the mechanical strength; and third, the quality of the material. In the electrical design consideration must be taken of the dielectric strength of the adjacent air, so that sufficient distance be allowed between the points at which the line voltage is impressed that it will not arc over to the pin or cross-arm under ordinary working conditions. In other words, make the potential gradient as gradual as possible from line wire to ground. These points of impressed voltage may vary greatly in an insulator of poor manufacture, although of the same electrical design. For instance, in two insulators of the same general design and different manufacture, the one having the greatest electrostatic capacity and, therefore, the greatest electrostatic field, will suffer from brush discharge and arcing over sooner than one having less electrostatic capacity and, therefore, less electrostatic field. In another case, two insulators of the same design but of different manufacture, the one possessing a body of greatest density and which is the most vitreous, will carry ordinary working voltages and line disturbances with less trouble than an insulator that does not possess these qualifications.

Due care must be exercised in the manufacture of porcelain insulators to secure the necessary dielectric strength between the tie wire or top groove and the point inside the insulator which is in closest proximity to the head of the pin, providing that pin is made of iron, which is usually the case in voltages in excess of 30,000, and in many cases misfortune has come to the engineer who depended to a large extent on the pin and cross-arm for additional insulating qualities. Practice dictates the fact that on the insulator alone should be the reliance of the engineer for his insulation, and all insulators, whether of porcelain or glass, should be tested with approximately three times the full line voltage brought to the inside of the insulator head, and the entire burden of correct and sufficient insulation should be placed on the insulator itself and a large number of line troubles would be prevented.

It has been the unfortunate habit of some engineers to consider the cost of the insulator of paramount importance, and, when one takes into consideration the importance of the insulators to the construction of a line, one is always led to wonder why, by the additional cost of a few cents to each insulator, a reasonable factor of safety is not obtained. It is, however, pleasing to note that many engineers are profiting by the sad experience of their brothers and are securing their insulators based on specifications that insure a reasonable factor of safety, and, in fact, are in some cases going to the other extreme and not only require the manufacturer to guarantee their insulators to stand a rigid test, both before and after erection, but in one case which the writer recently noticed an additional clause was inserted requesting the manufacturers to guarantee that the railroad would not break them in transit, which, we will have to agree, was rather a severe test.

Reverting once more to the electrical design, it is necessary in the design of an insulator that the factor of safety be sufficiently large so that the abnormal electrical strains that may be, and are, occasionally brought to bear, will not cause a puncture and consequently a shut-down of the line. For instance, an insulator designed to carry 50,000 volts should stand a dry test of approximately 150,000 volts, thus giving a fair factor of safety to enable it to withstand the possible surge voltages caused by short circuits, etc. This very fact of requiring a reasonable factor of safety in the electrical and mechanical design of an insulator has decided the limiting possibilities of the pin type of insulator as approximately 60,000 volts line voltage, as, to secure a factor of safety of three, it would be necessary to build an insulator of mammoth proportions and uncertain body, having a weight that is almost prohibitive to pin work. This brings us again to the conclusion that the only method of securing a proper factor of safety on the higher voltages would be to use a suspended type of insulator.

Having discussed the engineering design of a high-tension porcelain insulator, the writer thinks it might be of interest to take up its composition and the difficulties of manufacture, concluding with the tests to which all insulators should be submitted before being placed on the line. The porcelain of which a high-tension insulator is made is composed of certain proportions of English ball, China clay, some domestic clay, commonly called Tennessee, and some feldspar and quartz. The clay forms the body and gives the proper mechanical strength, while the function of the feldspar and quartz is to act as a flux and thoroughly permeate all the parts of the insulator, thus making a thoroughly vitreous mass when subjected to a sufficient heat. This mixture having gone through the various steps of grinding is forced through a filter of copper or silk cloth of 110 mesh to remove all impurities, and is then formed in the various shapes and designs suitable for the purpose for which it is to be used and placed in the drying room. After a sufficient amount of

moisture has been removed in this way the insulators are dipped in the glaze solution and are again placed in the drying room, after which they are placed in the kilns and subjected to a heat approximating 2,700 degrees Fahrenheit. The function of the glaze is to give the insulator the necessary color and also a smooth, even surface, in order that dust and rain may be easily dispelled. Ordinary unglazed porcelain would come from the kilns a pure white color with a comparatively rough surface, which would hold the dirt and moisture, so that it is necessary to glaze the insulator in order that a smooth, glassy surface may be obtained, as well as the desired color. If, in baking, the insulator is not subjected to the proper amount of heat the body of the clay will not be thoroughly vitrified. If, on the other hand, the insulator is subjected to too much heat the body of the clay will be porous. Therefore, it is necessary that the insulator be subjected to the exact amount of heat necessary to secure the desired results.

In determining the exact amount of heat to which these insulators shall be subjected, ordinary thermometers are not used, but a small carefully prepared cone of predetermined composition is utilized, which is placed at intervals in the kilns and is observed through small orifices by the attendant. These cones assume an erect position under any degree of heat below the desired one. As soon as the predetermined point has been reached, however, the cones melt and form glaze and at this point the heat is turned off and the ovens allowed to slowly cool, so that the wire may be thoroughly annealed. This process can not be hastened, but takes a certain well-defined time for its operation. When removed from the kiln the insulators are then subjected to a most rigid electrical and mechanical test to determine their qualifications for the work which they are designed to do, and all those not coming up to the specifications should be rejected at this time. A certain number of all insulators coming from the kilns are subjected to two electrical tests, one a dry test to determine the dielectric strength of the porcelain body and the other a precipitation test to determine as nearly as possible the action of the insulator under most severe climatic conditions.

The only objection that has been offered to porcelain as the composition of which the insulator should be made is the fact that in no other way than the above described can a porcelain insulator be properly tested, whereas the defects that might occur in glass can be detected by the eye. Unless an insulator is thoroughly vitreous and is practically non-absorbent and shows a fracture similar to glass, it is unfit for use under high potential stress. An ideal insulator would be one having a minimum amount of electrostatic capacity with a maximum amount of mechanical strength, but in the pin type of insulator a strange phenomena exists, inasmuch as it is necessary to sacrifice one condition to some extent to obtain the other good points, and an insulator of successful design is one which appearance shows contains a happy medium.

A New System of Wireless Telephony.

A description is given in the London *Electrician* for August 30 of a system of wireless telephony invented by Professor Majorana, which he described at a recent meeting of the Associazione Elettrotecnica Italiana. The system is based on the use of a spark-gap. For generating the spark a special rotating arrangement is used by which it is claimed 10,000 single sparks per second can be obtained. In wireless telephony a microphone is required that can be used with high-tension currents. It must be capable of withstanding a pressure of several thousand volts and of carrying a considerable current. These conditions gave rise to the Majorana hydraulic microphone, which depends on the capillary properties of fluid jets. A stream of liquid flowing from a suitably constructed opening divides itself into drops which follow each other at practically constant intervals. The frequency may be noticed acoustically by allowing the drops to fall on an elastic membrane which then gives out a sound of corresponding frequency. When mechanical oscillations are superimposed on the fluid jet periodical constrictions may be noticed which are of very nearly the same frequency as the superimposed oscillations. The drops thus force the membrane on which they impinge to give out sounds of a corresponding frequency. If the drops fall on a level surface at right angles to their direction, a covering of thickness, varying with the frequency of the drops, is formed. Professor Majorana has constructed his microphone on this principle and has thus obtained telephonic currents of extraordinary clearness and strength. This microphone consists of the usual mouthpiece and of a membrane fixed to a glass tube which moves freely under the oscillations of the membrane and through which slightly acidulated water flows. The liquid passes out of a special opening in the glass tube and strikes the upper surface of a "collector," consisting of two cylindrical pieces of platinum insulated from each other. On striking the middle of the "collector" the fluid spreads itself over the surface and puts the two halves in permanent connection. Thus a battery whose poles are connected in circuit with a telephone and this "collector" will send a constant current through it so long as the membrane is not affected by sound waves. When the membrane vibrates the aperture begins to oscillate, and varies the flow of drops so that the fluid on the "collector" is continually altering in thickness. If this circuit is connected in a suitable way with the spark-gap mentioned above, the intensity of the spark will correspond with the sound waves and will transmit to the receiving station the appropriate words and sounds. Professor Majorana obtained good results with this experimental arrangement, but found it an advantage to use a Poulsen arc in nitrogen instead of the spark-gap.

Power Plant for the Yukon.

Vice-Consul C. G. Woodward, of Dawson, reports on the improvements in Yukon territory, as follows:

An important work contemplated in the near future is the construction of a large power-house of approximately 1,000 horse-power near the western boundary, on the Yukon river some fifty miles below Dawson, for the purpose of furnishing electrical power to dredges on the Forty Mile Creek and its tributaries in Alaska and the Forty Mile and Klondike rivers in the Yukon territory. The company has a power-house in Dawson and furnishes this city and Grand Forks with electric light, and Dawson with water for household purposes and a hydrant system for fire purposes. On the completion of the power-house at the boundary the company intends doing away with the works at Dawson, other than to hold it as a reserve in case of accident to the new plant. The fuel used in their present plant is coal taken from the company's mine on Coal Creek, at which place the proposed plant is to be situated, the idea being that it is cheaper to convey electricity than coal. The output of the mine last year amounted to some 8,000 tons, the entire output being used by the company in Dawson. This coal landed at Dawson by the company's steamer costs about $12 per ton. With the plant at the mouth of the mine the coal costs about $2 per ton.

A New Mine Plant in Germany.

By B. F. Hirschauer.

THE use of electric motors for operating cable drums in mine work is constantly on the increase on the Continent, and within the last few years a number of plants of this kind have been installed in some of the principal mines. This is especially true as regards Germany, where the application of electricity in mining operations has received great attention of late. One of the most recent and best equipped outfits of the kind is the one which has been installed not long since at the Thiederhall mines, near Brunswick. The apparatus and wiring for the plant have been supplied by the Siemens & Halske Company, to whom the writer is indebted for the following account of the system which is now in use.

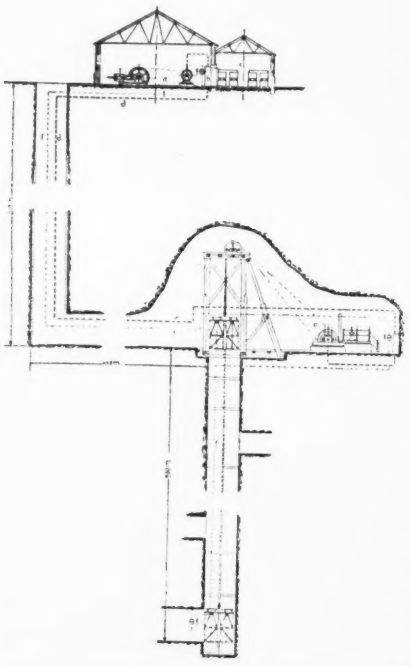


FIG. 1.—ARRANGEMENT OF ELECTRICAL AND HOISTING EQUIPMENT.

According to the conditions which exist in the shaft to which the present cable method is applied, the total weight to be lifted, including the weight of the cable, is about two and one-half tons. The net load which is taken out of the shaft in an eight-hour run is 200 tons, and the elevator makes thirty-two trips in an hour. The speed of driving the cable is twenty feet per second, with the usual load, but for hauling persons this speed is only half the above.

It is to be remarked that the shaft in this case is a blind shaft, and the upper end opens upon a mine gallery. The load is transferred from the elevator to the bottom of a second shaft which leads from the gallery up to the ground level. In the present case, therefore, the cable drum and motors are placed within the mine itself, and are installed in a chamber which is hollowed out at the further end of the gallery. The accompanying diagram (Fig. 1) shows the position of the shafts and the motor plant. As the level at the bottom of the blind shaft is 1,645 feet below ground level, and the upper gallery lies at a level of 987 feet, the load

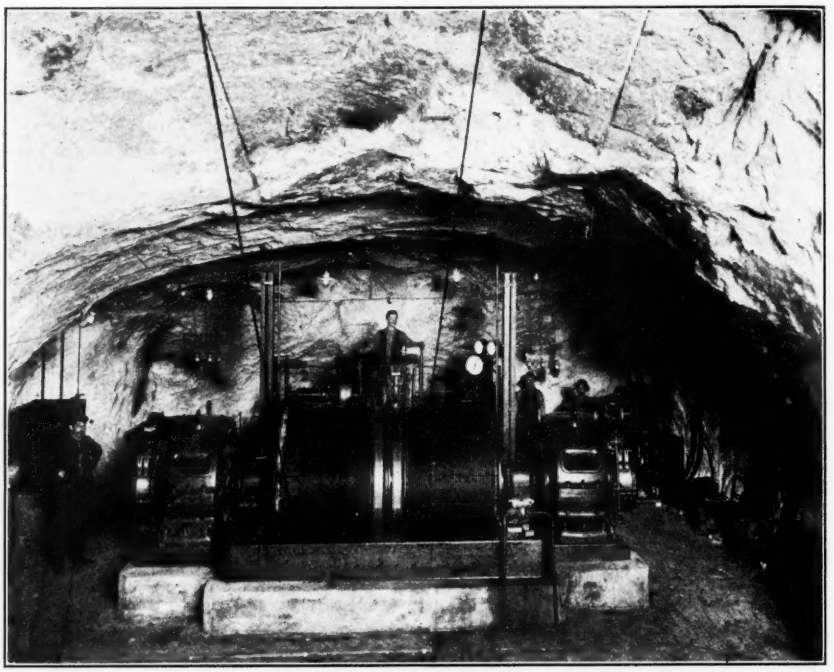


FIG. 2.—CABLE DRUMS AND MOTORS.

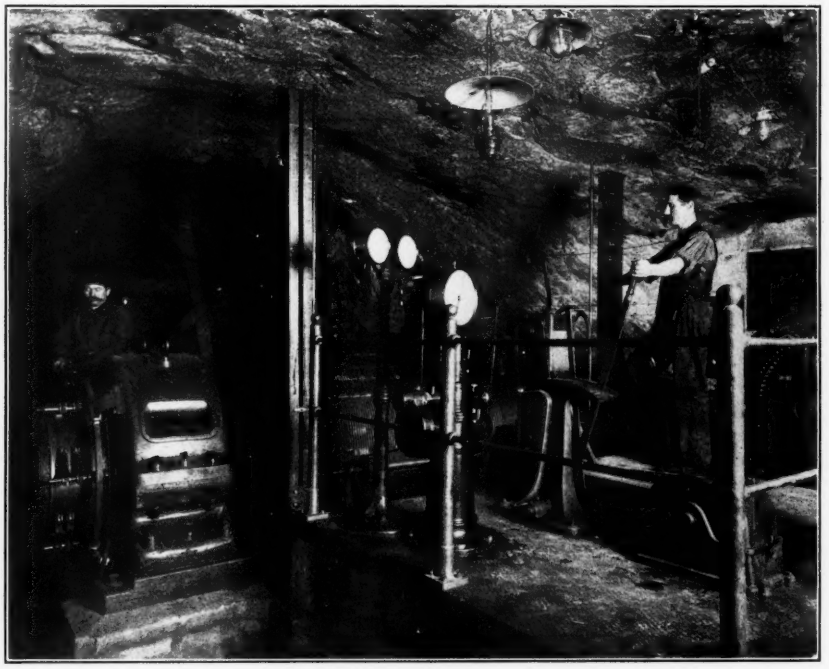


FIG. 3.—VIEW OF PLATFORM AND DRUMS, HOISTING EQUIPMENT.

is lifted to a height of 658 feet. In the second shaft leading to the ground the load is raised by a steam engine and cable

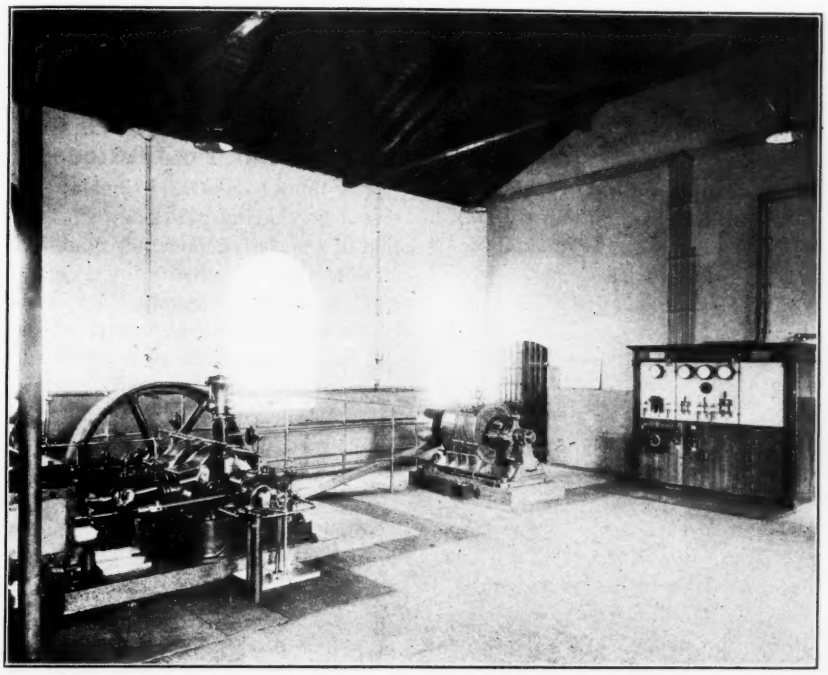


FIG. 4.—VIEW IN GENERATING STATION.

system. Before the present electric system was installed, the cable drum was driven by compressed-air engines, but this had the disadvantage of consuming a large amount of coal, and, besides, the engines were not as efficient as was required. Therefore, in order to secure the desired results for the operation of the cable it was decided to adopt the electric motor system. The use of direct current at 500 volts was decided upon for the motors. One of the principal alvantages to be secured from the direct-current system is the balancing of the variable loads during the operation of the cable drum by means of a storage battery working in parallel upon the circuit. In this way the steam engine which drives the dynamo can be run at an almost constant load and uses a comparatively small amount of steam. Another point is that a direct coupling of the motor upon the shaft of the drum can be employed, on account of the slow speed of the motor, which runs at seventy revolutions per minute.

FIG. 5.—VIEW OF STORAGE BATTERY EQUIPMENT.

One of the accompanying engravings (Fig. 2) shows a view of the cable hoist with the two motors which are coupled to the shaft. There is a similar motor on each end of the cable shaft, the motor being of the shunt-wound type. According to the above-mentioned conditions of working, the capacity of each motor is 150 horsepower. In this case there is no loss in resistances, as the motors are arranged so as to be connected in parallel, and with this coupling they are run at half the standard speed. The latter speed is used for carrying persons upon the elevator at the speed of ten feet per second. On the other hand, by using the parallel connection for the two motors, with a voltage of 500 at the terminals of each, the cable is operated at twenty feet per second. The mechanical losses of the plant are reduced to a minimum by lessening the number of bearings. The armature of each motor is mounted outside the bearing of the cable drum, and there is no outer bearing for the motor, the whole system running upon two bearings only. The bearings are provided with a very efficient type of self-oiling by rings. A good point about this method of mounting is that the armature can be very readily taken off the end of the shaft. Should an armature become damaged, it can be quickly removed and a reserve armature fitted in its place.

For operating both motors there is used a common starting box and a reversing box. The latter is connected to the starting box by a suitable lever. The resistance coils which are used with the starting box are placed at some distance off, under the floor of the platform, and are lodged so as to obtain the best possible cooling. The lower apparatus of the starting box is mounted upon the operator's platform and contains the contacts for throwing resistance into the circuit, and also a special rheostat arm by means of which the motor can be so connected that it operates as a dynamo upon the descent of the load, working upon the resistance, this combination giving an electric braking system. Besides this, there is a method of switching, patented by the Siemens-Halske firm, which allows the motor speed to be reduced to a very low figure when it is desired to run the cable at a slow

speed for inspection of the cable or the inside of the shaft. In this way the cable can be run by the motors at as low a speed as twenty-two feet per minute. By using the brakes at the same time, this speed can be still further cut down to about one-half the above.

Owing to the fact that the great number of contacts in the controlling apparatus gives a large angle for working, and it is not possible to operate the system directly by a lever, the lever which serves for the starter is mounted in a separate support, as will be noticed (Fig. 3) to the left of the operator. In like manner there is mounted to the right of the operator a second lever and support which is used for the reverser. In each case the lever is connected below the platform to the corresponding apparatus by means of a gear mechanism.

The braking system in the present case is well carried out. Two sets of brakes are provided, the first being a working brake and the second a safety brake. The first of these can be operated directly by the attendant by means of a foot pedal, or indirectly by hydraulic pressure. For the latter purpose the water pressure is furnished by a small pump arranged for the purpose. It is driven by an eccentric from the main drum shaft. The safety brake is operated by means of a counterweight, and comes into action automatically as soon as the elevator has been raised above the mouth of the shaft. A dashpot is adopted to the brake lever so as to give an easy action to the brake in this case. If need be, the operator is able to throw on the safety brake. He uses a small lever placed near at hand to carry this out and the lever causes the counterweight to be released. In order to prevent the elevator from arriving at the mouth of the shaft at full speed, in which case the safety brake would be suddenly thrown on, a retarding device is used. It is designed so that when the elevator comes within sixty-six feet of the shaft mouth, the lever of the motor starter is drawn back automatically. This causes resistance to be thrown into the armature circuit of the motors and reduces the speed gradually. But in order to give the operator the full control of the lever when the automatic device has been working, he is able to push the lever again in the opposite direction by means of an uncoupling device by which the retarding apparatus can be disconnected from the lever.

Upon the platform is mounted a speed indicator for the cable drum which gives the reading upon a dial mounted upon an iron column and also two instruments for indicating the height of the car in the shaft. In connection with the indicator is a signal bell which rings as soon as the car comes within sixty-six feet of the shaft mouth. Mounted near the speed indicator is an iron column with two dials which show the voltage and current of the circuit. The operator has all the indicating instruments near at hand, and can thus watch the current and voltage, as well as the speed. On the speed indicator is mounted a registering apparatus by which the curve for each lift of the car is recorded, so as to give a permanent record of the working of the apparatus.

The use of the storage battery in parallel upon the circuit gives a decided advantage in the present system. Owing to the fact that the battery is designed to provide for the maximum variations of load, the generator and the engine need only be of a sufficient capacity to take care of the average load, so that the expense of the storage battery is more than made up by the saving which results in the mechanical part of the plant. Accordingly the motors of the drum are designed to work at a maximum of 300 horse-power, while the generator is designed for a standard load of but sixty horse-power.

Another use of the storage battery is that it is able to furnish current for the motors when the steam engine is shut down. In certain periods of the day the elevator is not occupied in taking loads of material, but on the contrary certain other kinds of work are being done in the mine which makes it necessary to take the miners down the shaft. For this purpose the storage battery can be called upon to operate the motor at light load. In like manner the lighting of the station and of the mine can be carried out while the engine is stopped, by means of the battery. Another case is where an accident occurs to either the engine or the dynamo, when the battery is called upon to give the needed current while the repairs are being made. Fig. 4 shows a view of the engine room, and Fig. 5 a view of the storage battery equipment.

At the same time energy can be restored to the battery by means of the descent of the load. As soon as the car begins to descend, the motors are driven as dynamos and give energy to the batteries on the well-known principle. When the car descends there is no need of a special braking in order to lower the speed, but the operating lever can be left in the ordinary position, seeing that an electric braking action takes place automatically, and at the same time the batteries are charged by the current coming from the motors.

The capacity of the dynamos itself is sufficient to operate the system at half speed without the use of the storage batteries, that is, with the two motors connected in series.

Electric Mail Tubes for Italian Post-Office.

Vice-Consul H. M. Byington advises that a law having passed for the institution of the electric post in Naples, Milan, and Rome, the Italian minister of posts and telegraphs has nominated a commission to arrange for the opening of bids for the installation of the service. The vice-consul continues:

The electric post is an invention of a Neapolitan, Baron Piscicelli-Taeggi, who has also patented it in America. The invention renders possible the transmission of mail from one point to another with great speed. It is planned to reserve the electric post for the mail which has greater need of celerity, such as the transportation of special-delivery letters and local telegrams to and from the central office and the substations, as well as late matter which could be sent from the central office to the railroad station ten minutes before train time.

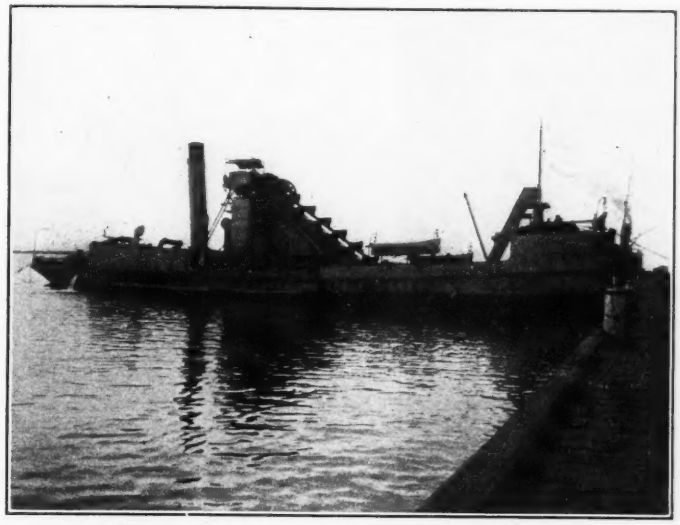
The principal tube will be the one which connects the central office with the railroad station. If the service in the cities proves a success it is the ultimate intention to inaugurate a similar service between the principal cities in Italy. It is estimated that in this way the time between Naples and Rome can be reduced from five to two hours.

Electric Power in Copper Mines.

There has been a rapid increase in the use of electric power in place of steam in the Lake Superior copper mines during the recent years, says *The Mining and Scientific Press*. The Calumet and Hecla mines are making broad use of it. A short time ago work was started of clearing a site for the large electric power plant of the Copper Ranging Consolidated Company next to the Michigan smelter on the south side of Fordage Lake. It has been recently decided to install an electric plant for lighting the buildings and to purchase two electric locomotives for use underground at the Victoria mines. These will be used in long drives and cross cuts where it is difficult to get trammers to work.

Flaming Arc Lamps Abroad.

SOME time before joining forces with the Excello Arc Lamp Company, of New York city, Mr. Otto Baerwinkel, now secretary and manager of the Excello company, made an extensive trip through a number of foreign countries in the interest of several British concerns devoted to the manufacture of electrical supplies. One of his main lines was the flaming arc lamp, which was then receiving considerable attention. Being particularly interested in the installation of the Excello flaming arc, Mr. Baerwinkel made some notes and secured a number of interesting photographs in connection with the installation of this lamp in foreign lands. The trip proved to be an extended one, taking fifteen months, during which time some 50,000 miles were traveled. Mr. Baerwinkel started from London, England, on Friday, April 13, 1906, and while some superstitious friends were fearful of the consequences, no accident or serious hitch of any kind was experienced during the trip.

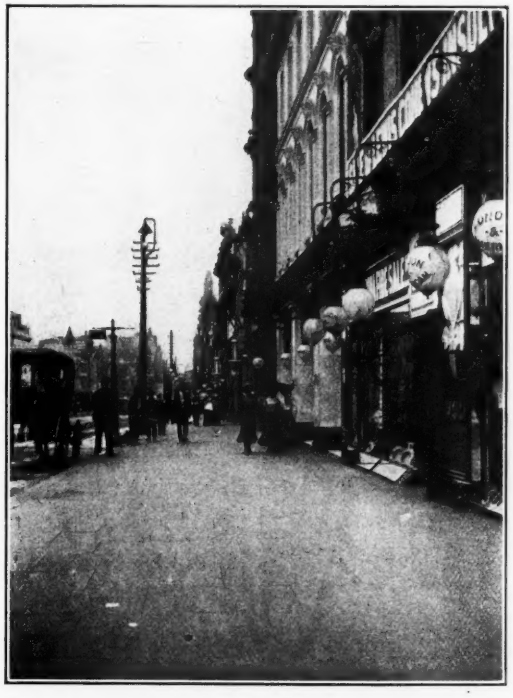


DREDGER, STEWART ISLAND, NEW ZEALAND.

Egypt was the first country to be subjected to a general canvass. This country can not be called a very prosperous field for the electrical manufacturer. The staple products grow, and are not manufactured. There were on the whole some sixty arc lamps in use. The government railroad, however, has placed in service some 150 Excello flaming arc lamps, which have been found suitable for railroad work. There is a great deal of sympathy with the French element in Egypt, and a good many orders find their way to the manufacturer through French representatives, unless French apparatus is preferred altogether. There are five central stations, one in each of the principal cities, some of these being held by French stock companies. The largest engineering firm is Thomas Cook & Son, Limited, which has elaborate works in El Boucar, a suburb of Cairo. This is where the well-known Nile steamers are built.

In connection with the trip through Egypt, Mr. Baerwinkel noted that, contrary to the general assumption, the Suez canal is not illuminated by arc lamps, but that according to the rules of the company operating this waterway, each passing ship is provided with searchlights installed to port and starboard of the bow.

The island of Ceylon, while affording most beautiful tropical scenery and vegetation, did not prove a good market for electrical supplies. Electrical appliances



A MAIN STREET IN MELBOURNE, AUSTRALIA.

ARC LAMP SUSPENDED FROM TREE, NEW SOUTH WALES, AUSTRALIA.

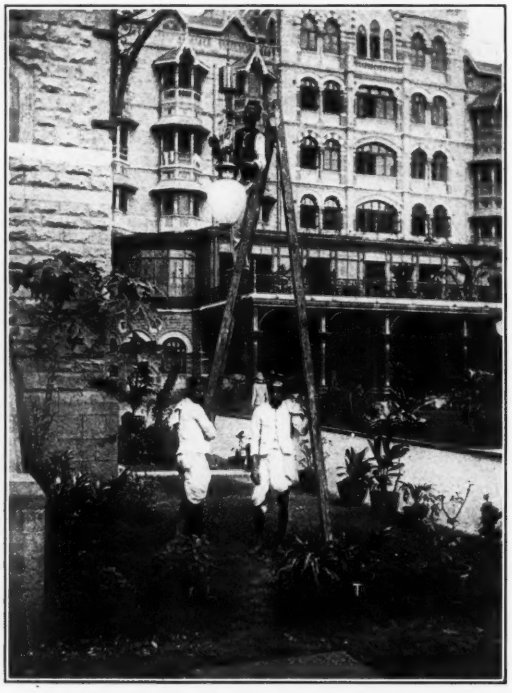
would, in the main, be required only in the two harbors and for the comparatively small traction and electric-lighting systems at Colombo.

The use of kerosene is not permitted, owing to the danger from fire, and gas, somehow or other, is not in practical use, so that the opportunity for electrical illumination is very good. A number of mills had just been wired, with others following this example. Arc lamps were in great demand, one mill putting up 200 Excello miniature lamps. As far as the flaming arc lamps are concerned, these are now burning in all of the principal towns in India. An order of unusual size was placed by the Bengal Nagpur Railway Company, which is using them for lighting certain stations and tracks. The leading hotel in India, the Taj Mahal Palace Hotel, is using some ninety Excello arc lamps.

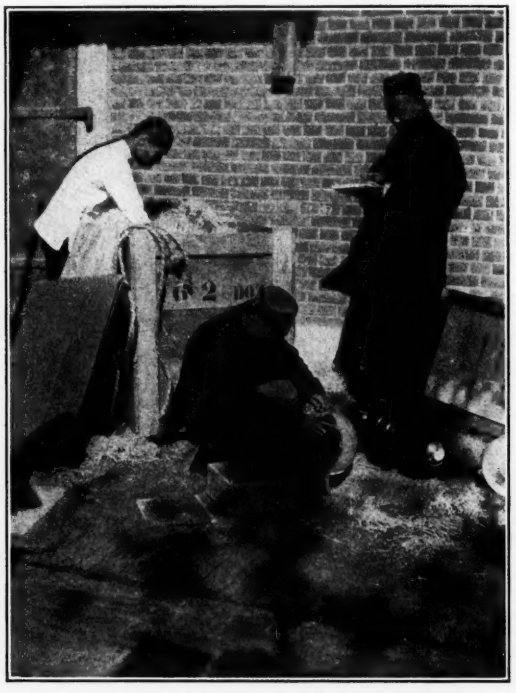
Double-Lamp Street Lighting, Melbourne, Australia.

Palm Garden, New South Wales, Australia.

In India, at the time of this visit, there was considerable prosperity, the weaving and spinning mills, located chiefly in Bombay and Bengal, being very busy and hardly able to keep up with their orders.



Lamp Trimming by Coolies in Bombay, India.



Unpacking Lamps at Shanghai, China.

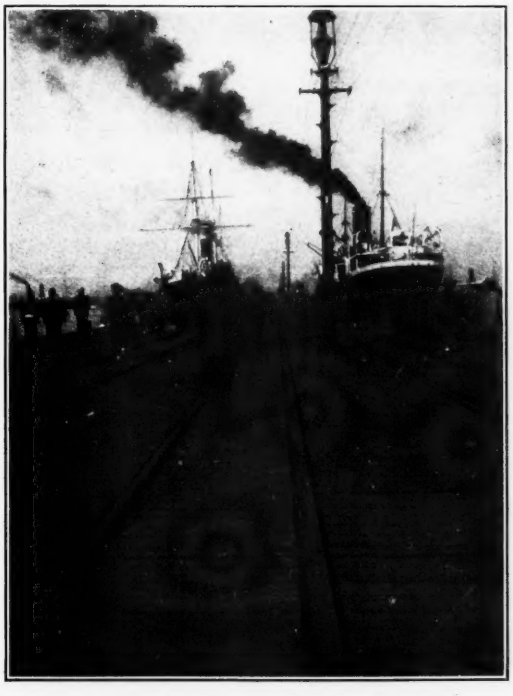
The British crown colony of Burma is devoted principally to the growing of rice and lumber. The capital, Mandalay, famous through Kipling's poem, affords the principal market for electrical supplies.

Street Lighting, Shanghai, China.

Coolies at Kobe, Japan, Assembling Arc Lamps.

Animal labor in the form of elephants is still used in the large mills. The yard of Messrs. Steel Brothers was built to accommodate fifty or sixty of these animals. At the time this visit was made, however, there were only three working, in overwhelming competition with electric power. These elephants have a book value of $3,500, and ten per cent depreciation is charged against them each year. Considerable electric construction work was going on in Singapore, where the docks have been acquired by the British government and remodeled.

At the time of Mr. Baerwinkel's visit to China, American goods were rather unpopular, due to the boycott. He did not suffer through the prejudice which was then prevailing against American goods, how-



Lighting of Main Pier, at Yokohama, Japan.

Broadway of Tokyo, Japan.

ever, but was able to discover this animosity through his association with American representatives who happened to be traveling in that country at the time. The Excello flaming arc lamp is being used in a number of street installations, notably that at the Chinese Bund, Shanghai, where some eighty are employed. The imperial palace at Pekin also uses these lamps.

The Japanese are rapidly developing as manufacturers of dynamos, motors and electrical instruments. They have not as yet, however, begun the manufacture of arc lamps. With the exception of some American engineers in a large telephone factory, there were very few foreign engineers to be seen. The flaming arc lamp is becoming quite popular with the Japanese, several of the more prominent streets and some of the larger stores being illuminated with this form of lamp.

Close to 1,000 flame arc lamps have been sent to Australia. One installation in Sydney, New South Wales, has attracted particular attention. In Sydney, Hyde Park was looked upon as a most dangerous place at night. It was eventually decided to improve matters by putting in an up-to-date lighting system. Eighty Excello lamps were installed. The illumination was so satisfactory that it was decided to reduce the number of lamps installed to twenty and put the balance of the eighty in commission elsewhere.

In New Zealand the Excello lamps have been installed for a number of purposes. One installation in which the lamps were subjected to considerable exposure was in dredging work in harbor improvements.

A feature of the installation of these lamps in foreign countries, and one which is of considerable importance, is the fact that they are being trimmed and maintained by unskilled labor. In fact, in some instances the lowest form of human intelligence is relied upon to keep the lamps in operation.

Rejuvenated Sons of Jove.

C. B. Roulet, Mercury, of Dallas, Tex., has announced that all faithful Jovians shall assemble at the annual meeting, to be held on Jupiter's day, October 15, at Dallas, Tex. Many important matters relative to the further good of the order are to be considered, as well as the annual election of officers. The organization of the Jovian Cloister (the second degree of Jovianism) will be perfected at the meeting.

An Improved Sleeping Car for Interurban Electric Railways.

Harris F. Holland, of New York city, president of the Holland Palace Car Company, which went into the hands of a receiver about four years ago, is working on plans for an interurban combination sleeping and parlor car, which, he claims, will eclipse the car that he invented five years ago. He expects to put the new car on the market within the next year. Two cars designed by Mr. Holland are now in service on the Illinois Traction System between Springfield, Ill., and St. Louis, Mo. It is understood that these cars have not proved the success that was hoped. Mr. Holland believes that the next three or four years will see a demand for sleeping cars and parlor cars for interurban roads.

The new car is a combination parlor car and sleeper, and can be made in two lengths, one of fifty-four feet six inches, and the other of sixty-two feet. The fifty-four-foot-six-inch car will contain twenty berths, ten to a side; or twenty chairs, ten to a side. The sixty-two-foot car will provide room for four more berths or chairs, two to a side.

Mr. Holland is quoted as describing the new car as follows:

"As in my other car, two chairs, when reversed and made up, will constitute a lower berth. It will be the same with this car, except that the chairs will be shaped so as to be more comfortable than the straight-backed chairs in my first car. The upper berths will swing down from above, as in the old car, except they will be hung lower, thus giving the occupant more room.

"A double floor was provided in the old car, between, the sections of which the partitions and guide rails of the compartments were made to fold into the six-inch space between the two floors. This has been eliminated in the new car and I am perfecting plans for a partition of a different character. Just what this is I can not say until my patent has been secured. The brass grill work at the top of the compartments has been done away with also.

"The elimination of these things will make the new car weigh six tons less than the first one and will make a difference of about $5,000 in the cost in favor of the new car. My new car can be manufactured for about $15,000. The car will take four eighty-five-horse-power motors, while the old car required four 150-horse-power motors. The compartments will be just as strong, durable and as private as those of the first car, and in no way will the arrangement detract from the strength of the car."

The car will have no baggage compartment, but there will be two toilet rooms and a smoking compartment, the latter capable of seating five persons.

Electrical Supplies for the Navy Department.

The Bureau of Supplies and Accounts will open bids in Washington, D. C., October 8, for the following material for delivery at the points enumerated below:

Forty-eight miscellaneous batteries, Annapolis, Md.; 22,800 feet waterproof cable, Pensacola, Fla.; one cabinet and panelboard, Norfolk, Va.; 100 feet of special conductor, 300 feet incandescent lamp cord, and twenty-four double-pole cutouts, Annapolis, Md.; two electric drills, League Island, Pa.; miscellaneous electrical supplies, Norfolk, Va.; miscellaneous combination oil and electric lights, New York city; three multipolar motors, Pensacola, Fla.; seventy-five fuse plugs, twenty-four plugs, six jump-spark plugs, Annapolis, Md.; miscellaneous switches, New York city; twelve knife switches and ten pounds black friction tape, Annapolis, Md.; 26,505 condenser tubes, Norfolk, Va.; thirteen sets wireless telegraph apparatus, New York city; 3,300 feet double-braided wire, Norfolk, Va.; sixty pounds cotton-covered wire, 1,500 feet double-covered wire and forty-eight zincs for Annapolis, Md.

Water-Power Development in Norway.

United States Consul F. S. S. Johnson, of Bergen, reports that a tunnel is being constructed which will bring the water from the great Ringedalsvand of Norway (into which the Skjaeggedalsfos falls) down to the fiord where it will be used for power purposes.

From the lake named there is a tunnel 1,000 feet long to another small one, known as the Lillevand. From this point there is a tunnel 15,500 feet in length, ten feet wide and eight and one-half feet high, to the face of the rock facing the Sorfjord. From this tunnel the water will be conveyed in pipes down the 1,350 feet decline to the fiord. Down at the sea level and close to the wall of rock is the power station, from which the electric power will be conducted along the four-and-one-half-mile stretch to a factory at Odda. This power of water coming down the steep decline is estimated at 40,000 horse-power, of which 20,000 will be at once utilized when the factories are working.

PRIMARY AND SECONDARY WATTMETER STANDARDS.

BY H. W. YOUNG.

In order that integrating wattmeters may be maintained in an accurate and efficient condition it is necessary that they be compared at certain intervals with known standards, and it is obvious that the standards for this purpose should have the following qualifications: They should be highly accurate, unaffected by wide variations in frequency, wave form, or by stray fields and should have a low temperature coefficient. For convenience in operation and to avoid a multiplicity of instruments they should have a wide range, which may be obtained primarily by a long scale, and where possible the range should be further increased by combining several current and potential capacities in one meter.

To combine laboratory accuracy with the speed necessary in commercial work, two sets of standards should be provided, which may be designated as "primary" standard or "precision" meters for extreme accuracy and "secondary" or working standards for use directly with the service meters.

Primary Standards—In the selection of primary standards permanent accuracy should be the first consideration, as these instruments must be depended upon over long periods without recalibration, as it is obvious that any change in the accuracy of the primary standards will, in turn, affect the secondary standards and through these the entire meter system will in time be rendered inaccurate. The "precision" meter should be occasionally checked or calibrated at some well-equipped standardizing laboratory, and for this purpose the manufacturer should maintain a standardizing laboratory to which the instrument could be sent for comparison with absolute standards when desired. If the manufacturer will agree to conduct this laboratory in the interests of the purchaser and keep the instruments in calibration for, say, a period of five years without expense to the customer, other than transportation charges and cost of actual repairs, it will be readily seen that there will be but slight excuse for central station managers having any doubt as to the accuracy of their meters.

Essentials of Primary Standards—The primary standards should be so designed and constructed that they will not be affected by stray fields, frequency or wave form; should have a low temperature coefficient and preferably be provided with a high-grade thermometer in order that absolute temperature corrections may be noted and applied to the reading. The bearings or suspension should be so designed and the torque of such value that whatever friction may initially exist will remain constant over a long period of service, and the controlling springs should be thoroughly aged to prevent any change

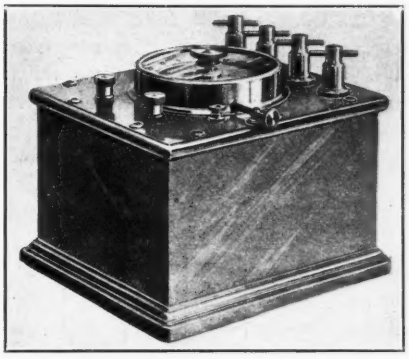


FIG. 1.—PRECISION WATTMETER, 5-20-100-AMPERE CAPACITY.

in calibration due to changes from their initial value.

In order that the magnetic circuit within the meter may produce a maximum, constant and uniform torque, the meter should preferably be of the zero reading type. This arrangement can be secured by a construction in which the movable coils travel a very small distance and the readings are obtained by turning a torsion head carrying an index passing over a scale. The torsion of the controlling spring is increased until the restraining torque of the spring just balances the

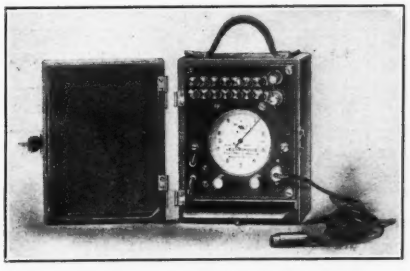


FIG. 2.—ROTATING STANDARD INTEGRATING WATTMETER, 5-10-20-40-AMPERE CAPACITY.

turning torque of the meter, when the movable coil will come to the zero position and the position of the index on the scale indicates the reading.

It will be noted that the "Siemens dynamometer" meets many of the specifications called for in the selection of a primary standard, but owing to its construction can not be made "Astatic" and is, therefore, more or less subject to the influence of stray fields. Aside from this very important point, the dynamometer, owing to its necessarily delicate suspension, is not at all portable, and to secure good results must be calibrated at the place and position in which it is to be used, a condition impossible for the average central station to meet.

The Kelvin laboratory balances have long been recognized as of the highest types of primary standards, but the usual construction is such that they can only be used as bench or fixed standards.

Precision Wattmeters, Voltmeters, Ammeters—The essentials of a primary standard outlined above are fully met by what might be termed an Americanized form of the Kelvin balance, in that they are semi-portable and require no adjusting or leveling.

Fig. 1 illustrates a commercial form of Kelvin type precision wattmeter, this particular device being provided with three current capacities of five, twenty and 100 amperes respectively and in conjunction with a resistance box, the meter may be used on potentials up to and including 2,000 volts. The system of fixed and movable coils is astatically arranged, thus rendering the indications free from the disturbing effects of external magnetic fields—a feature of the highest importance, as in many instances difficult and expensive tests have been rendered absolutely valueless by reason of the fact that after all calculations were completed it was discovered that the meter had been influenced by stray field effect and the test was, therefore, inaccurate.

This type of precision meter can be used interchangeably and with equal accuracy (within one-tenth of one per cent) on alternating-current and direct-current circuits, thus rendering unnecessary the maintaining of two separate sets of standards. In the past many central stations have experienced considerable difficulty in keeping their standards in calibration, owing to the damage entailed during shipment to and from the manufacturer; for instance, a standard which was suspected or known to be incorrect would be forwarded to the manufacturer or to a standardizing laboratory for recalibration and then returned to the owner. Owing to the inherently delicate construction of the average laboratory standard the possibility would always exist that when the meter reached its destination the calibration might or might not be any more accurate than it was before standardization. Practically all users of electrical measuring instruments have been through this experience and are apt to rather doubt the feasibility of keeping standards in check

by sending them to the manufacturer, unless they can be carried and looked after by a special messenger.

With the construction employed in the Kelvin meters illustrated herein this problem has been successfully solved, and from actual experience it has been demonstrated that shipment of a standard to and from the factory is feasible and the accuracy will not be affected. A large number of meters are being handled in this manner and less than one-fifth of one per cent of the total number have had their calibration impaired by shipment, and even in this small percentage the error in calibration was less than one-half of one per cent. With such a record it is conservative to say that any central station using this type of Kelvin meter can depend upon its standards being maintained within one-tenth of one per cent under all conditions and have the additional assurance that this accuracy is backed by a laboratory of the highest order.

The secondary standards for testing alternating-current integrating meters may consist of "portable indicating" wattmeters used in connection with a stop-watch or of a "rotating" watt-hour meter arranged with suitable current and voltage capacities. The latter method is to be preferred, as it eliminates the stop-watch with its attendant errors and troubles; is not affected by changes in load and enables more work to be accomplished in less time and with fewer men than is possible when using the indicating meter. With the same care in handling, the rotating standard having a light moving element and latest form of ball-bearing will maintain its initial accuracy much longer than the ordinary indicating meter employing pivot bearings.

The requirements of a reliable secondary standard are fully met by the portable rotating standard meters, one form of which is illustrated in Fig. 2. This device consists of a specially designed integrating wattmeter element having series parallel measuring coils, a special registering mechanism and all the elements mounted in a self-contained portable case. The particular meter described has current capacities of five, ten, twenty and forty amperes and voltage capacities of 100 or 200 volts. The various capacities are secured by manipulating a set of contacts or connection plugs located on the supporting base. By means of a push-button switch the voltage circuit may be opened and closed, thus starting or stopping the indicating pointer at will.

To conduct a test with a rotating standard it should be connected in series with the meter to be tested and the connection plugs so arranged that the capacity of the standard will be approximately the same as that of meter under test. The proper connections having been made, the load should be adjusted to the desired value and a direct comparison made of the number of revolutions of the disc in the meter under test with the number of revolutions shown on the counters or dials of the rotating standard. The percentage of error may be found directly by dividing the number of revolutions made by the meter under test by the number of revolutions of the standard. For example: If the meter under test makes ten revolutions

CALIBRATION DATA FOR WESTINGHOUSE STANDARD PORTABLE INTEGRATING WATTMETER.

REVOLUTIONS OF WESTINGHOUSE PORTABLE INTEGRATING WATTMETER FOR 94 PER CENT TO 106 PER CENT REGISTRATION OF SERVICE METER.

	Type.	Service Meter. Capacity, Amperes	Service Meter. Revolutions. Heavy Load.	Service Meter. Revolutions. Light Load.	Standard Meter. Capacity, Amperes.	94 Per Cent.	95 Per Cent.	96 Per Cent.	97 Per Cent.	98 Per Cent.	99 Per Cent.	100 Per Cent.	101 Per Cent.	102 Per Cent.	103 Per Cent.	104 Per Cent.	105 Per Cent.	106 Per Cent.
*Westinghouse.	B	5	25	...	5	26.5	26.25	26.00	25.75	25.5	25.25	25	24.75	24.50	24.25	24.00	23.75	23.50
		10	25	...	10													
		20	25	...	20													
		40	25	...	40													
	&	5	..	1.0	5	1.06	1.05	1.04	1.03	1.02	1.01	1	.99	.98	.97	.96	.95	.94
		10	..	1.0	10													
		20	..	1.0	20													
		40	..	1.0	40													
	C	80	15	...	40	31.8	31.5	31.2	30.9	30.6	30.3	30	29.7	29.4	29.1	28.8	28.5	28.2
		80	..	1.0	40	2.12	2.1	2.08	2.06	2.04	2.02	2	1.98	1.96	1.94	1.92	1.90	1.88
		3	30	...	5	19.08	18.90	18.72	18.54	18.36	18.18	18	17.82	17.64	17.46	17.28	17.10	16.92
		3	..	2.0	5	1.27	1.26	1.24	1.23	1.22	1.21	1.2	1.19	1.18	1.16	1.15	1.14	1.13
General Electric.	I	5	30	...	5	28.62	28.35	28.08	27.81	27.54	27.27	27	26.73	26.46	26.19	25.92	25.65	25.38
		10	30	...	10													
		5	..	2.0	5	1.91	1.89	1.87	1.85	1.84	1.81	1.8	1.78	1.76	1.75	1.73	1.71	1.69
		10	..	2.0	10													
		15	30	...	20	23.85	23.62	23.4	23.17	22.95	22.72	22.5	22.05	21.83	21.6	21.38	21.15	20.93
		15	..	2.0	20	1.59	1.57	1.56	1.54	1.53	1.51	1.5	1.48	1.47	1.45	1.44	1.42	1.41
		25	30	...	20	35.72	35.38	35.05	34.71	34.37	34.04	33.7	33.36	33.3	32.69	32.35	32.00	31.68
		50	30	...	40													
		25	..	2.0	20	2.38	2.36	2.34	2.32	2.29	2.27	2.25	2.23	2.2	2.18	2.16	2.14	2.11
		50	..	2.0	40													
		5	30	...	5	22.98	22.76	22.53	22.3	22.08	22.7	22.53	22.3	21.08	20.9	20.63	20.41	20.18
		10	30	...	10													
		40	30	...	40													
Fort Wayne.	K	5	..	2.0	5	1.59	1.57	1.56	1.54	1.53	1.51	1.5	1.48	1.47	1.45	1.44	1.42	1.41
		10	..	2.0	10													
		40	..	2.0	40													
		25	30	...	20	23.85	23.62	23.4	23.17	22.95	22.72	22.5	22.27	22.05	21.82	21.6	21.37	21.15
		50	30	...	40													
		25	..	2.0	20	1.59	1.57	1.56	1.54	1.53	1.51	1.5	1.48	1.47	1.45	1.44	1.42	1.44
		50	..	2.0	40													

It is recommended that test be made at approximately 100 per cent and four per cent of full load if these loads are within the range of standard meter.
Load service meter so as to give revolutions stated in table in approximately one minute time.
Where possible, the capacity of coils used should be the same for both service and standard meters.
* Westinghouse round pattern and type "A" meters make fifty revolutions at full load.

while the standard meter makes 10.4 revolutions, the ratio would be 0.96, showing the meter under test to be four per cent slow. This direct comparison applies only when the meter under test has the same full load speed as the standard, namely, twenty-five revolutions per minute. When testing meters which run at different full load speeds than the standard, it is usually necessary to use a constant or multiplier, the value of which depends upon the ratio of the normal speed of the meter under test to that of the standard.

In order that the rotating standard illustrated herein may be conveniently employed in testing meters in which the full load speed is other than twenty-five revolutions per minute, the following table has been prepared as applying to Westinghouse, General Electric and Fort Wayne meters. By the use of this table any one of the three makes can easily be tested with the one rotating standard.

In explanation of the use of this table the following examples are given:

(1) If it is desired to test a Westinghouse service meter by using the rotating standard, the two meters should be connected in series and loaded so as to give one revolution of the disc in approximately one minute's time for a light load test and for full load, twenty-five revolutions of the disc in the same time. The number of revolutions made for these two loads by the standard—if the service meter is correct—would be one and twenty-five respectively. If the number of revolutions made by the standard is 1.03 the service meter is three per cent slow at light load. If the number of revolutions of the standard is 0.97 the service meter is three per cent fast at light load. From this example it will be seen that the accuracy can be determined for any speed within six per cent fast or slow, reading same directly from the table without any calculation whatever.

(2) If it is desired to test a five-ampere General Electric meter the load can be adjusted to give—say two revolutions at light load and thirty revolutions of the disc at heavy load in approximately one minute's time. If the meter is correct the standard will show 1.8 and twenty-seven revolutions respectively. If the standard shows 1.86, the service meter is three per cent slow at light load. If the standard shows 1.75 the service meter is three per cent fast at light load.

(3) If it is desired to test a five-ampere Fort Wayne meter the load can be adjusted to the same value as with the General Electric meter. If the meter is correct the standard will show 1.5 and 22.53 revolutions respectively. If the standard shows 1.55 the service meter is three per cent slow at light load. If the standard shows 1.46 the service meter is three per cent fast at light load.

Fig. 3 illustrates the proper connections for testing a two-wire meter in accordance with the table. If it is desired to test three-wire meters the standard should be connected into the circuit in such a manner as to place it in circuit with one side

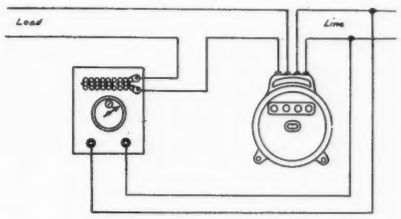


FIG. 3.—DIAGRAM OF CONNECTIONS FOR TESTING TWO-WIRE METER.

of the meter under test, the other side of the circuit being left open. When the test is conducted in this manner the rotating standard pointer will revolve twice as fast as the disc of the meter under test which has but one-half of its current winding in use during the test. To effect a direct comparison, the number of revolutions made by the meter being tested should be multiplied by two.

The Chicago Electrical Show.

The third annual electrical show under the auspices of the Electrical Trades Exposition Company will be held at the Coliseum, Chicago, Ill., January 13-25, 1908. At a recent meeting of the stockholders the following officers were elected: president, Samuel Insull; vice-president, Ellsworth B. Overshiner; secretary-treasurer, Stewart Spalding. Executive committee: Ellsworth B. Overshiner, chairman; Louis A. Ferguson, Stewart Spalding. Directors: Samuel Insull, G. H. Atkin, Stewart Spalding, T. P. Gaylord, Ellsworth B. Overshiner, George B. Foster, Louis A. Ferguson, H. B. McMeal and H. V. Bennis.

Homer Niesz will again manage the show. It was largely due to his untiring efforts that the two previous exhibitions were such pronounced successes. Mr. Niesz's headquarters will be at 1006 Monadnock Building, Chicago, Ill.

Special Trains for the Street Railway Conventions.

In connection with the meeting of the American Street and Interurban Railway Association, the American Street and Interurban Railway Manufacturers' Association, and the auxiliary associations, at Atlantic City, N. J., October 14-18, the Pennsylvania Railroad will operate through express trains to Atlantic City, leaving New York, foot West Twenty-third street, at 9.55 A. M., 2.55 P. M. (Sunday only, 7.55 A. M.), with special Pullman parlor cars attached. The rate authorized for this occasion is based on a fare and one-third on the certificate plan. Those desirous of obtaining accommodations in the special parlor cars will communicate with C. Studds, eastern passenger agent, Pennsylvania Railroad, 263 Fifth avenue, New York city.

Copper Mining in Jamaica.

In a report from Kingston, Consul F. Van Dyne says that while copper deposits exist in Jamaica, and numerous attempts have been made to work this metal, beginning as early as 1857, the mining of copper has not hitherto proved successful commercially. The consul writes of new development plans:

It appears now, however, as the result of the investigations conducted by an expert American mining engineer who has been prospecting here since last November, that the difficulties which have prevented the profitable working of this metal have been overcome, and that paying copper will be added to the list of staple products of the island. The deposits are located principally in the parish of Clarendon, and the ore contains gold and silver as well as copper.

Two thousand acres of land have been acquired by the interests which the mining engineer represents, and shafts have been sunk in three places—in one place to a depth of 300 feet, with tunnels 125 and 255 feet long. Tests of qualities of ore have been made by the government chemist, and several shipments have been made to a Denver, Col., assay works. The results obtained in both cases yielded copper in paying quantities. It is announced that a company with a capital of $250,000 will be organized to work the mines, and that within a short time operations on a large scale will be begun.

The declared exports show that copper ore of the value of $1,671 was shipped from this port to the United States during the last fiscal year.

THREE-WIRE DIRECT-CURRENT GENERATORS.[1]

BY B. T. McCORMICK.

It is the purpose of this paper to give briefly the principles of operation of three-wire generators and to call attention to some of their advantages. The three-wire generator is the outgrowth of the well-known Edison three-wire system, in which two direct-current generators are connected in series, with a line known as the "neutral" tapped into the point where the machines are connected together. A load, usually light, is fed between each outside wire and the neutral. If the load is balanced on either side, no current will flow in the neutral, while in the event of an unbalanced system the neutral will be required to carry the current corresponding to the amount of "unbalancing." The main lines must be of sufficient capacity to carry current corresponding to the combined output of the machines at a voltage equal to twice the voltage of one machine, while the neutral need be only large enough to take care of the unbalancing. Such an installation when applied to a well-balanced 120-volt incandescent lighting load, combines a saving in copper as a result of transmitting at the higher pressure of 240 volts, together with the advantage of a 120-volt installation for supplying the lights. It also possesses the advantages of a 240-volt system for power purposes, the motors being connected across the outside lines.

The three-wire generator consists of a direct-current generator of the standard type, but provided with slip rings to which are attached taps from the armature winding as in a rotary converter. A transformer known as the "balancing transformer" is mounted behind the switchboard or in some convenient position, and connected across the slip rings. A tap is brought out of the centre of the transformer winding, to which the neutral wire is connected. Fig. 1 shows diagrammatically a three-wire generator in its simplest form, the two-pole diagram being used for simplicity. "A" and "B" are the main leads and "N" is the neutral. So long as the loads on each side of the neutral are equal, the balancing transformer, "T," takes only the magnetizing current for which it is designed, but where one side is loaded more heavily than the other, the excess of current flows through the neutral into the middle tap of the transformer, and divides, as shown by the arrows "P" "P," half flowing to one ring and half to the other. In so dividing, the ampere turns on one half of the transformer, due to the direct current, exactly balance the ampere turns in the other half, thus the magnetic flux in the balancing transformer remains constant regardless of the amount of direct

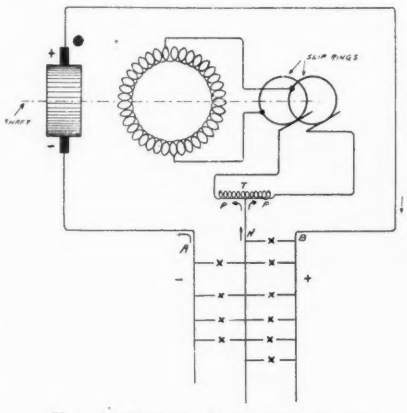


FIG. 1.—SIMPLE ARRANGEMENT OF THREE-WIRE GENERATOR.

current flowing. From the above, it is evident that the requirement for a balancing transformer is, that it shall have sufficient current-carrying capacity to carry the unbalanced current and a sufficient number of turns and core area to generate a counter electromotive force, the effective value of which is $\frac{E}{\sqrt{2}}$ where "E" is the normal direct-current voltage between brushes.

A core type of transformer is admirably suited to such service, and the coils on either side of the neutral tap are comprised of sections staggered from one leg of the core to the other, in order to reduce the magnetic leakage to a minimum.

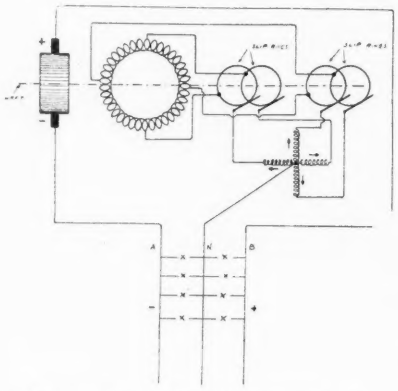


FIG. 2.—TWO-PHASE COMBINATION OF BALANCING TRANSFORMERS.

Probably the most efficient three-wire outfits consist of a generator as described above, but provided with a two-phase combination of balancing transformers, as shown in Fig. 2. The centre taps are tied together and the neutral wire joined to the point of connection. Two pairs of slip rings are used, connected to taps in the armature winding situated ninety electrical degrees apart. Such a combination of two transformers results in a more even current distribution in the armature than can be secured by the use of a single transformer.

The cost of the balancing transformer is a very small part of the total cost of the apparatus, and depends of course upon the amount of unbalancing to be allowed. Ordinarily an allowance for about twenty-five per cent unbalancing is sufficient. A concrete case will serve best to illustrate the size of transformer required. Suppose we wish to design a two-phase combination of balancing transformers for a 100-kilowatt, 250-volt machine to take care of twenty-five per cent unbalancing. The amount of current taken by two transformers is that corresponding to twenty-five kilowatts, or 100 amperes, and for one transformer fifty amperes. As the current divides on entering the centre tap of the transformer, the copper sections need be made only large enough to carry twenty-five amperes. The number of turns and core area must be such as to give a counter electromotive force of $\frac{250}{\sqrt{2}}$. The volt ampere capacity must therefore be $\frac{250}{\sqrt{2}} \times 25$. As a balancing transformer has but one winding, whereas an ordinary transformer has both a primary and a secondary, the above value must be divided by two to get a basis of comparison with a standard transformer $\frac{250}{\sqrt{2}} \times 25 \times {}^1/_2 = 2.2$ kilowatts. Roughly speaking, therefore, the transformer should be about the size of a 2.2-kilowatt lighting transformer.

The generator, is shunt-wound, differs from standard generators only by the addition of the slip rings, while if compound-wound, the alternate poles are connected so that half the poles receive their series excitation from each of the main leads. In this way the corresponding characteristics are still maintained even if one side of the system is completely unloaded.

Three-wire generators can be operated in multiple with one another, or in multiple with two-wire generators, and it is often convenient to operate a 120-volt machine in multiple across one side of 240-volt, three-wire system, to maintain a better balance, in case that side is unloaded.

The two-wire generator with rotating direct-current balancers, as a competitor of the three-wire generator, possesses a great many good points, but the cheapness, simplicity and compactness of the three-wire generator are points not to be overlooked in deciding on a three-wire system.

[1] A paper read at the annual convention of the Canadian Electrical Association, Montreal, September 11-13.

THE INCANDESCENT LAMP IN CONNECTION WITH ELECTRIC SIGNS.

BY BENJAMIN WALL, MANAGER METROPOLITAN ENGINEERING COMPANY.

A few years ago a title similar to the above would have been misunderstood by most people, but to-day who does not know the meaning of the words "Electric Signs"?

The writer, while in Atlantic City recently, was impressed by the beauty and variety of the electric signs which illuminate the Board Walk of this resort. There are thousands of incandescent lamps used for this purpose alone, there being 1,500 used in one sign (so the manufacturer states). The installation for this sign is equal to that of some of the largest apartment houses in New York city, so that it will readily be seen that the electric-sign business is assuming large proportions.

Philadelphia also proved interesting. A ride from the Broad Street Station of the Pennsylvania Railroad to Fairmount Park by way of Broad and Diamond streets was a revelation. Within the last year the electric-sign display on Broad street has more than doubled. Hardly an automobile concern, hotel, theatre or restaurant can be found where the electric sign is not used for advertising purposes.

The sidewalks of Chicago, as a great many readers of this article will remember, are literally covered with electric signs. Denver and Columbus are close seconds in this respect; in fact, it is hard to name a city in the United States where the electric sign is not in evidence, serving to illuminate the streets at night and to advertise the wares of manufacturers in such a manner that the public is compelled to take notice thereof.

In Greater New York there are more than 10,000 panel signs used, containing twenty-four lamps each, in some instances four-candle-power lamps being used, and in some eight-candle-power lamps.

The United Cigar Stores Company has adopted the electric sign, over fifty having been erected in and around Greater New York, 9,000 lamps being used nightly for its sign business alone.

The Great Atlantic & Pacific Tea Company is now taking up the sign question, and has installed panel signs at quite a number of its stores in Greater New York.

The Huyler company also is using the electric sign for the same purpose, having recently erected signs in New York, Brooklyn, Long Branch and other nearby resorts.

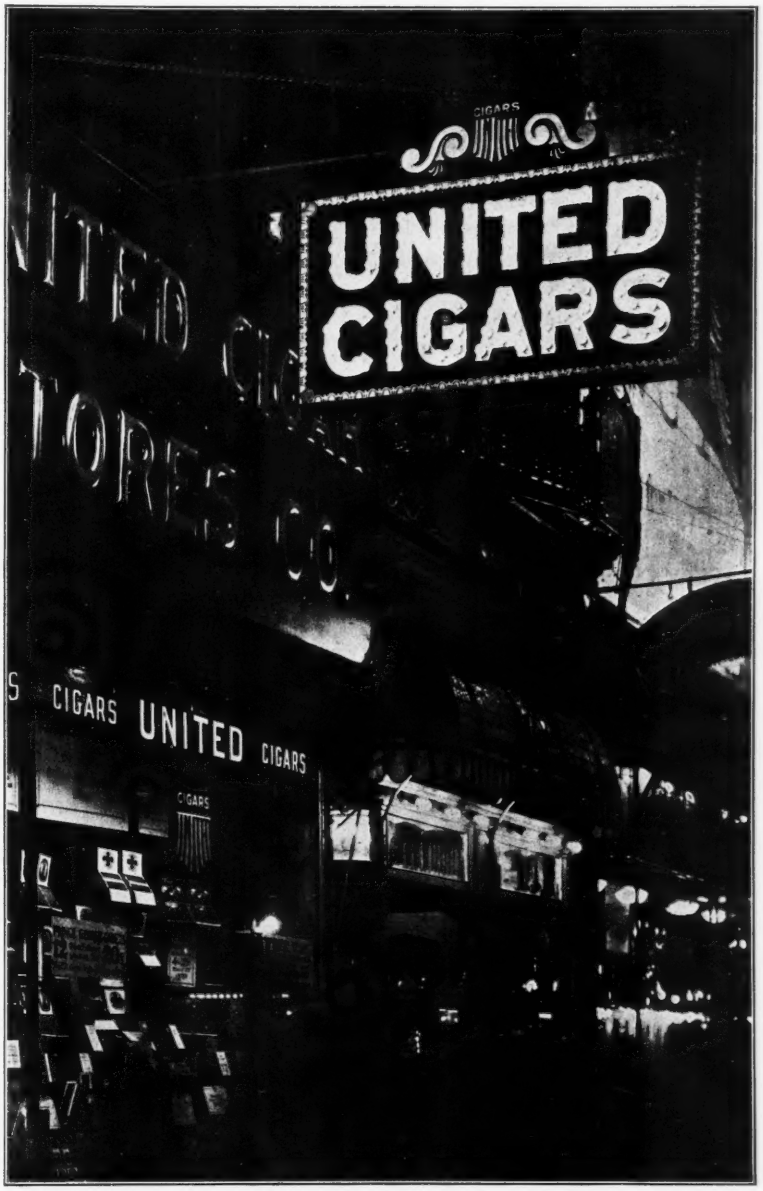
The roof sign for large display work seems to be the most popular, and the variety of designs of this type of signs are innumerable, such as trade-marks, floral displays, reproductions of lightning flashes and clock dials.

Theatres have without question the right of way of the electric-sign proposition. Where can a theatre be found that does not use the electric sign. For instance, the Keith & Proctor installation for electric signs alone equals 8,000 sixteen-candle-power lamps.

The Anheuser-Busch Brewing Company also is a great user of the electric sign, using an equivalent of 5,000 sixteen-candle-power lamps. New York city has three of these large Anheuser-Busch signs, and in Norfolk, Va., on the roof of the storage plant of this company may be seen the largest electric sign in the South, using about 1,800 incandescent lamps.

The Beverwyck Brewing Company, of Albany, also believes the electric sign a necessary part of its advertising expense, having recently erected on the smokestack of its brewery in Albany a four-sided sign which is 180 feet from top to bottom, at a height of 300 feet from the ground. This sign contains about 2,000 eight-candle-power lamps.

The Colgate company, of Jersey City, has recently taken up the electric-sign subject and has a sign on its factory in Jersey City which will (with proposed alterations) be the largest roof sign in the



TYPICAL OVERHANGING STREET SIGN.

world. Dimensions are to be over 200 feet long by fifty feet high, with specially constructed letters, the letters in all containing 2,582 eight-candle-power lamps, or an equivalent of 1,291 sixteen-candle-power lamps.

Thus it will be seen that the electric sign is proving to be an important factor to the incandescent-lamp manufacturer and to the central station, and in the instances above cited, where four or five concerns are using 20,000 sixteen-candle-power equivalents or about 80,000 lamps per night for their roof-sign display work, there is evidence of the universal use of the incandescent lamp for advertising purposes.

The Electrical Show at Madison Square Garden.

An electrical show under the auspices of the Electrical Show, Incorporated, will be held at Madison Square Garden, New York city, September 30 to October 9. The Brooklyn Edison Company will make an elaborate exhibit of a complete apartment fitted up with electrical apparatus of every description. The Eastern Cahill Telharmonic system will render a musical concert each day furnished by the Telharmonium. The New York Edison Company, it is stated, will give a complete exhibition of all kinds of new electrical devices. An exhibition Marconi wireless telegraph system will be shown, and it is also stated by the management that a device designated as the Photophone, invented by Charles Hartwell, will be on exhibition.

An exhibit of some novelty will be furnished by the National Dairy Supply Company, where it is stated that a herd of Jersey cows will be stabled, showing an electric milking machine in operation.

The National Electric Lamp Association will occupy a large space, showing the latest developments in incandescent lighting.

The Electrical Testing Laboratories, New York city, will also have an interesting exhibit.

Among those exhibiting will be the American Wire Brush Company, the New York Beck Lamp Company, the India Rubber and Gutta Percha Insulating Company, the Driver-Harris Wire Company, the Monaton Construction Company, Lord Electric Company, Federal Sign Company, Metropolitan Engineering Company, F. Alexander Manufacturing Company, General Electric Company, G. M. Gest, Westinghouse Electric and Manufacturing Company, Safety Car Heating and Lighting Company, and Henry Fallek.

A Proposed Code of Ethics for Electrical Engineers.

Under the title "Proposed Code of Ethics: Principles of Professional Conduct for the Guidance of the Electrical Engineer," the Committee on a Code of Ethics, composed of Charles P. Steinmetz, Harold W. Buck and Schuyler Skaats Wheeler, chairman, has offered the following code to the membership of the American Institute of Electrical Engineers. The code was presented at the twenty-fourth annual convention held at Niagara Falls, N. Y., June 27, revised by the committee, considered at a meeting of the board of directors, August 30, and ordered printed and submitted to the membership for suggestions. The committee was appointed at the convention held in Milwaukee, Wis., June, 1906. The proposed code follows:

GENERAL PRINCIPLES.

1. In both his professional and his business relations the electrical engineer should follow strictly the same ethical principles that are recognized in the social relations of every-day life. He should consider himself personally responsible for the character of the enterprises with which he is associated professionally.

2. Before entering into professional relations, it is therefore the duty of the electrical engineer to satisfy himself that the enterprises with which he connects himself are of a legitimate character. If, after becoming associated, he finds them to be of a questionable nature he should sever his connection as soon as possible. It should not be considered an excuse that his connection extends only to legitimate engineering work.

3. An electrical engineer permitting the use of his name in any enterprise or exploitation becomes morally responsible for its character. He should therefore not allow the use of his name in connection with anything upon which he is not qualified by training and experience to exercise competent judgment.

4. The electrical engineer should take care that credit for engineering work is attributed to those who, as far as his knowledge of the matter goes, are the real authors of such work.

5. The electrical engineer should incline toward and not away from standards of all kinds, since standardization is peculiarly essential to the general progress of the profession. This applies to construction, measurements and expression or nomenclature, as well as to conduct, or ethics. Even the tendency to give individuality by providing special construction may usually be avoided with advantage.

RELATIONS OF THE ELECTRICAL ENGINEER TO HIS EMPLOYER, CUSTOMER OR CLIENT.

7. The electrical engineer should consider the protection of his client's interests as his first obligation, and therefore should avoid every act that would be contrary to this duty; if any other consideration such as professional obligations or restrictions interfere with his so acting, in accordance with the expectation of his client, he should inform him of the situation.

8. The electrical engineer, whether consulting, designing, or operating, may not accept financial or other compensation, directly or indirectly, from more than one side or party interested in the same matter.

9. Electrical engineers in a position to decide on the use of inventions, apparatus, etc., should not be financially interested in their use, as by receiving a royalty, etc., unless the matter is clearly understood by the client or employer.

10. Electrical engineers should not accept employment while financially interested in a rival concern except with the express permission of both parties. An electrical engineer may be employed by more than one party, as in the case of a consulting engineer, when the interests of the parties do not conflict and it is understood, as is usual in such cases, that he is not expected to devote his entire time to the work of one party but is free to enter into other engagements. A consulting engineer permanently retained by a party should notify other prospective employers of this affiliation before entering into relations with them. A consulting engineer when not exclusively retained by one side may advise rival concerns, with the full knowledge of all of them and upon taking care that the interests of the parties do not conflict in the particular matter handled.

11. Operating engineers should consider themselves responsible for defects in apparatus or dangerous conditions of operation, should bring the same to the attention of their employers and insist upon the removal of the causes of danger as soon as feasible.

12. An electrical engineer should in general be considered directly responsible to his employer or client for the successful fulfilment of the work upon which he has been engaged and for its satisfactory performance as a whole. It should therefore be clearly understood at the outset just what the extent or the limitations of responsibility of the engineer are to be. Whether he has been employed merely as designer or whether he is retained to design and to superintend construction; whether to design only the chief features, or also to pass upon all details of the apparatus that is to be installed. Attention should be directed to the fact that defects in the manufacture of material or apparatus is a matter distinct from the matters of design or installation. An engineer should not be held responsible for the unsatisfactory performance of a plant resulting from defective apparatus furnished, undess he has undertaken to include this subject.

RELATIONS OF THE ELECTRICAL ENGINEER TO THE OWNERSHIP OF THE RECORDS OF HIS WORK.

15. If in executing his work, the electrical engineer uses data or information which are not common and public property, but which he receives, directly or indirectly from his employer, or if the problem solved by the engineer is met in the pursuit of his work for his employer, and is not of such character that his attention would have been directed to it regardless of his relations to his employer, the products of his work, in the form of inventions, plans, designs, etc., are not his private property, but the property of his employer.

16. If in the execution of the work the consulting engineer uses only his own knowledge or data or information which are public property by prior publication, etc., and receives no engineering data from his employer or customer, except performance specifications, the results of the work, such as inventions, plans, designs, etc., are the private property of the engineer, and his employer or customer is entitled to their use only in the specified case.

17. All the work done by the engineer in the form of inventions, plans, designs, etc., which are outside of the field of engineering for which his employer has retained him, are the engineer's private property.

18. When an engineer or manufacturer builds apparatus from engineering designs supplied to him by his customer, the designs remain the property of the customer and should not be duplicated for other customers without express permission. When the engineer or manufacturer and his cus-

tomer are jointly to work out designs and plans or develop inventions, a clear understanding should be arrived at before the beginning of the work regarding the proportionate rights of ownership in any inventions, designs, etc., that may result, since in such case both parties should be considered to have rights therein.

19. Any engineering data or information which an electrical engineer obtains, directly or indirectly, from his employer or customer, or which he creates as a result of such information, must be considered by the engineer as confidential; and while the engineer is justified in using such data or experience in his own practice as going toward his education, the publication thereof without express permission is improper, as is also its use in producing for other parties, work that is characteristic of the original customer or employer.

20. Designs, data, records and notes made during his engagement by an engineer employed on salary under permanent engagement, and referring to his work, are his employer's property. The same matters in the case of a consulting electrical engineer paid by fee or by commission, are the property of the consulting engineer.

21. A customer, in buying apparatus, does not acquire any right in its design beyond the use in the apparatus purchased. A customer of a consulting engineer does not acquire any right to the plans made by the consulting engineer except for the specific case for which the apparatus was built or the plans made.

RELATIONS OF THE ELECTRICAL ENGINEER TO THE GENERAL PUBLIC.

22. The electrical engineer should endeavor to assist the public to a fair and correct general understanding of engineering matters, spread the general knowledge of electrical engineering and discourage wrong or exaggerated statements on engineering subjects published in the press or otherwise, especially if these statements are made for the purpose of, or may lead to, inducing the public to participate in unworthy schemes.

23. Controversies on engineering questions, however, should never be carried on in the public press, but should be confined to the technical press and the engineering societies.

24. First publication of inventions or other engineering advances should not be made through the public press but rather through the engineering societies and the technical press or through trade bulletins.

25. The publications which an electrical engineer is justified in making through the public press should therefore be of a historical, educational, instructive or similar character and should not relate to controversies between engineers or on engineering questions, to new inventions, etc., nor contain technical criticisms of fellow engineers, and it should be considered unprofessional to give opinions without being fully informed on all the facts relating to the question, and on the purpose for which the opinion is asked, with a full statement of the conditions under which the opinion applies.

26. In giving expert testimony before judicial bodies, the electrical engineer should confine himself to brief and clear statements on engineering or historical facts. He should not give personal opinions without so expressly stating, and should avoid pleading on one side or the other.

RELATIONS OF THE ELECTRICAL ENGINEER TO THE ENGINEERING FRATERNITY.

30. The electrical engineer should take interest in and show due regard for the electrical engineering societies and the technical press, and should assist his fellow engineers by exchange of general information, experience, etc., through them.

32. He should not seek a position held by another electrical engineer.

33. Where engineering work is in charge of an electrical engineer, no other electrical engineer should undertake the work except on request of or in cooperation with the electrical engineer who had charge of the work before, unless the latter's connection with it has already terminated.

35. In engineering work in charge of a board of engineers, the respective limitations of the authority of each should be decided at the outset, and each electrical engineer should give full and complete information on his part to the other engineers and insist on this being reciprocated.

RELATIONS OF THE ELECTRICAL ENGINEER TO THE STANDARDS OF HIS PROFESSION.

40. The title "electrician" should be applied to those having practical training sufficient to enable them to carry on intelligently certain classes of electrical work, such as the installation of electric lights and bells, and the operation of small electric plants.

41. The title "electrical engineer" should be applied only to graduates from electrical engineering schools of recognized standing, and such men as possess an equivalent knowledge of electrical engineering. Letters usually employed to denote college degrees should be used only by those holding such degrees.

42. The title "consulting electrical engineer" should be applied only to those electrical engineers who are engaged in consulting work, and who possess such knowledge and experience in electrical engineering as would qualify them to full membership in the American Institute of Electrical Engineers.

Lighting on a Moonlight Schedule.

TO THE EDITOR OF THE ELECTRICAL REVIEW:

We shall be under lasting obligations to you if you can and will enlighten us on the following:

Our contract for lighting the city reads, after setting forth the price, etc., for each arc light: "Provided the lights are operated on what is technically and usually termed the moonlight schedule." Under this kind of a worded contract, would we be compelled to operate our lights when the moon is up, provided it was cloudy?

J. H. SAVAGE,
President and General Manager, Plaquemine Electric Light and Power Company.

Plaquemine, La., September 17.

Large Chilean Concession for Power Plant.

Consul A. A. Winslow, of Valparaiso, Chile, reports that the German Transatlantic Electric Company has a concession to erect a hydraulic electric power and lighting plant on the River Maipo, above Santiago, at an estimated cost of $4,015,000 United States gold, of which about $1,295,040 will be for materials and machinery that must be imported. It is estimated that it will take about five years to complete the undertaking. The company has petitioned the government of Chile for the free entry of the machinery and material for a period of five years.

Annual Convention of the Empire State Gas and Electric Association.

The annual convention of the Empire State Gas and Electric Association will be held in the auditorium of the New York Edison Company, No. 44 West Twenty-seventh street, New York city, on Wednesday, October 2. At the morning session, to be held at 10 o'clock, there will be presented the report of the executive committee and the reports of the various subcommittees which have been appointed during the year. There will also be an account of the publicity work done on account of the association.

In the afternoon several very interesting papers will be presented and discussed. The subjects have been announced as follows: "The Meter Testing Situation and Report of Meter Committee," by R. M. Searle; "Gas Standards," by Alfred E. Forstall; "Buying Light," by E. L. Elliott; "Franchise Taxation," by L. T. Palmer; "The Agitation for Underground Distribution in Place of Overhead," by W. W. Cole; "Municipal Ownership in New York State," by Glenn Marston.

The reading of these papers will be followed by the election of officers.

On the evening of Tuesday, October 1, a joint meeting and reception will be held under the auspices of the Street Railway Association of the State of New York and the Empire State Gas and Electric Association, in the concert hall at Madison Square Garden, New York city, at 8.30 o'clock. At this meeting addresses will be made as follows: "The Work of the Public Service Commission, Second District, and Its Policies with Relation to the Corporations under Its Supervision," by the Hon. Frank W. Stevens, chairman public service commission, Second District; "The Electric Railway Situation of To-day," by Henry I. Pierce, president International Railway Company, Buffalo, N. Y.; "Control of Gas Companies by State Commissions," by Dr. Alexander C. Humphreys, president Stevens Institute of Technology; "Public Control from the Corporate Standpoint," by Everett W. Burdett, chairman of Committee on Public Policy, National Electric Light Association.

It is expected that the members of the Public Service Commissions of the First and Second Districts will be present, and an invitation is extended to every one interested in public service corporations to attend this meeting and reception.

REVIEWS OF CURRENT ENGINEERING AND SCIENTIFIC LITERATURE

Electric Cranes.

In the first section of a series of articles on electric cranes, H. H. Broughton speaks of the relative advantages of electricity and hydraulic power for crane operation. He points out that until recently the hydraulic apparatus was preferred, but as soon as engineers were convinced that the electric motor had reached a reliable stage of development, it had jumped into favor, and that engineers are now beginning to recognize the insuperable advantages of the electric over the hydraulic. On every hand installations are being remodeled in favor of electric driving. Such instances are furnished by the docks of Hamburg, Rotterdam, Antwerp, Cologne, Copenhagen, Genoa, Naples, Glasgow, Heysham, Middlebrough, Bremen, Barcelona, Amsterdam, Capetown, East London and many others. A large number of dock owners and railway companies in England are putting down electric installations and new docks and works are almost without exception being fitted with electrically driven cranes, capstans, coal-hoists, lifts and tips. This rapid spread of electric power is in a large measure due to the application of electric power to steel-works plant and machine tools. Mr. Broughton divides cranes broadly into two different classes—fixed and traveling. The former are subdivided into two types of constant or variable radius. The traveling cranes are subdivided into five distinct types, depending on the arrangement of the traveling carriage and the location of the tracks. There are several designs for each type, and each seems particularly suited to a certain class of work. Some of the advantages claimed for the electrically driven cranes are stated briefly, and one is the facility of distributing the power over the central plant, another the high load-factor procurable; a third, the efficiency of the system for transmission of power and the efficiency of the apparatus under all loads. A fourth is the great flexibility of the system and the range of speeds obtainable. With proper attention the machinery is perfectly reliable, is unaffected by the weather and can be made in a large measure automatic. Another advantage is that the power of operating cranes can be obtained in all large towns at a cost of less than two cents a kilowatt-hour. If the hydraulic system is adopted a special plant must generally be installed.—*Abstracted from the Electrician (London), September* 6.

Manchester, England, Corporation Tramways.

A description is given here of the recent improvements of the Manchester, England, corporation street railways. This city is surrounded by boroughs and urban districts, in most of which street railways are in operation. In some cases the lines are owned by local authorities and in others by companies. By means of leases, and in some cases by the exercise of running powers, the cars of the corporation now serve a population of three-quarters of a million. Some years ago all of these street railways at Manchester were worked by a private company, although some of the lines were owned by the corporation. After much negotiation the whole undertaking was transferred to the corporation and the other local authorities concerned; but an arrangement was made whereby the company continued to operate the lines by means of the horse system then in use until they were changed over to electric. This work was done gradually, each line as it was converted being taken charge of by the corporation. The completion of the electrification occurred in the spring of 1903. The power for operating the system is obtained from the corporation's electricity department, mainly from the Stuart street station. This station has a total output of 57,000 horse-power, about 17,000 kilowatts being available for the railways, the rest being taken up by the lighting and power load. The power from this station is distributed to twenty substations, at 6,500 volts, three-phase. The corporation now has in operation 564 cars, 307 of which are four-wheeled, single-truck cars, and 257 double-truck cars. Nearly all of these are double-deck cars, single-deck cars being used only where there are low bridges over the routes. About seventy-five new cars are now being built. These cars are nearly all fitted with standard equipment, but some changes are being made, as the new type of grid resistance is being used instead of the old type. The corporation has also installed a vacuum impregnating plant adopted for treating motor parts. In this a field coil or an armature is dried out thoroughly and is then soaked with insulating varnish which is forced into the windings under pressure. The steam is then admitted and the armature baked for several hours. This treatment produces a solid weatherproof coil or armature. An interesting method of testing motor parts has been developed which consists of placing them in a powerful alternating-current field, when a short circuit is at once detected by the local heating of the defective coil. A high pressure test is also applied for detecting weak insulation. An elaborate system of parcels delivery has been developed, by means of which at a cost of a few cents parcels are collected and carried by the regular passage cars. Prepaid stamps are used on these packages, which may be obtained from any conductor. The extent of this system of railways is indicated by the following figures: The total length is about 170 miles. The car mileage, for the year ending March 31, 1907, was over 66,000,000 and over 615,000,000 passengers were carried. The income was $5,400,000. —*Abstracted from the Tramway and Railway World (London), September* 5.

The Siemens-Schuckert Single-Phase Commutator Motor for Electric Railways.

A description is given here of the single-phase commutator motor developed by the Siemens-Schuckert Company, the information being obtained from an article by Dr. Rudolph Richter in a German periodical. This motor is of the series type but differs from the single-phase railway motors, which have been put out by other companies, in several particulars. In the rotor winding the high resistance leads from the main armature coils are not carried directly to the commutator segments, but on the contrary, the current flows through high-resistance conductors placed in slots, which are situated in the active field. These high-resistance conductors consequently serve the double purpose of improving the commutation at starting by virtue of the resistance opposed to the flow of secondary currents induced in the coils short-

circuited under the brushes, and by transformer action from the main poles, and also of contributing to the useful torque quite as effectively as the conductors of the main winding. It is said that this arrangement increases the motor's output by about ten per cent. The action of these leads, however, is not entirely depended upon for preventing wasteful current, as a special coil has been introduced for assisting in this. This coil is supplied with current in any of a number of alternative ways. One of these consists in connecting it across a portion of a special transformer, or it may be tapped from suitable points of the secondary of the main transformer carried on the car and interposed between the high-tension trolley and the motor. This coil may be wound on the stator teeth lying in the neutral zone. It may embrace but one tooth, but it has been found to give better effects when it is spread in several slots, the axis of the coil, of course, being kept in the neutral zone. In other words, the shunt coil is spread out in the same way as the compensating series winding which is also employed. The field of the motor thus has three coils, the main excitation winding, the compensating series winding and the compensating shunt-winding. A fourth winding may be added for supplying the field for neutralizing the reactance voltage in the coils undergoing commutation during the normal running. With these four coils uniformly distributed the appearance of the motor is identical with that now commonly associated with polyphase induction motors, and investigations have shown that the equivalent of these four stator windings may be obtained by a uniformly distributed equipitch winding if the proper interconnections be made. Referring to a specific motor designed for twenty-five cycles with a one-hour rating of 175 horse-power at seventy-five revolutions per minute, the total weight is said to be 6,000 pounds. This size of motor has been selected for the Midland Railway, and it is said that the total weight of the electrical equipment for those motors will be thirty-three tons. This is equivalent to 5½ tons for each motor or 2.77 tons for the motor proper and 2.73 tons for the remainder of the equipment.—*Abstracted from the Electrical Engineer (London), September 5.*

The Commercial Production of Electrolytic Disinfectant.

A discussion is given here of a report submitted by Dr. F. W. Alexander to the Borough of Poplar, London, England, of which Dr. Alexander is the health officer. An interesting part of this report consists in the description of a continuous process of producing electrolytic disinfectant and the cost of running this plant. It is said that the use of the method has been entirely satisfactory from every point of view, particularly with regard to the public health of the district. The system adopted at Poplar is to make up a solution containing chloride of sodium and magnesium, and to pass this slowly through a small regulating tank into a series of four double troughs or cells placed one above the other, so that the liquid descends continuously by gravity. Each trough is divided laterally by a partition, and in each of the two divisions five distinct elements, consisting of one positive and two negative electrodes, are suspended. The positive electrodes are of thin platinum wire wound on slate slabs, and the negative electrodes of zinc. There are then four troughs, each containing ten elements or forty cells in all. The liquid passes through this series and is finally discharged into a carboy. A bottle arranged at the side of the tier of cells supplies the sodium hydroxide which is used as a preservative, and which flows drop by drop into the carboy as it is filling. This neutralizes the free hypochlorous acid, thus saving the chlorine. As the liquid passes through the troughs it is subjected to the action of a current of from fifteen to seventeen amperes and from 230 to 250 volts, thus giving about six volts per cell. The liquid is stirred continuously during the treatment. The objects aimed at in devising this apparatus are to make the working as simple and automatic as possible. During electrolysis the concentration of the electrolyte changes. For this reason a regulator is required. It is said that during ten months' operation it has been necessary to take the apparatus apart and clean it but twice. Every day after working, the electrolysers are emptied, the fluid being saved for recharging. The electrolysers are then washed and filled with water which softens any deposit formed upon the electrodes. Before starting the work the electrolysers are again emptied and washed out. During twelve months of operation, 17,000 gallons of fluid have been manufactured of a strength between four and four and one-half grammes of available chlorine per meter. This material is issued to the public in pint bottles and sold to other departments of the local government at the rate of two cents a gallon. It is used for watering roads, market places and elsewhere. During the twelve months under consideration about 25,000 kilowatt-hours of electrical energy have been used, which have been paid for at the rate of three cents a kilowatt-hour. Four tons of salt have been used and two tons of magnesium chloride. The cost of preparing the material during the year was about $2,920, while the costs for the three preceding years when carbolic acid was used for the same purpose varied from $3,300 in 1903 to $4,300 in 1905. It is estimated that the installation brought about the saving of nearly $1,500. —*Abstracted from the Electrical Magazine (London), August.*

Practical Telephone Studies in the University of Minnesota.

The course in telephony, both theoretical and experimental, which is offered in the University of Minnesota is here outlined briefly by Professor George D. Shepardson. The preparation for this work is similar to that required for any other branch of electrical engineering, the telephone work being a special course which the students take in the senior year. The laboratory work which is offered is optional, only those wishing to specialize in telephony taking it. The equipment consists of collections of various standard makes of apparatus and a number of special devices for testing these instruments. There are two oscillographs for photographing wave forms up to 7,500 periods per second; there is a Duddell thermogalvanometer suitable for measuring currents as small as one ten-millionth of an ampere, and a variety of electrodynamometers and recording apparatus. The studies carried on in the laboratory are designed to give the men engaged in them a very definite knowledge of the methods of testing and investigating telephone apparatus. Some of the special appliances are described in detail. One of these consist of a test flageolet which was blown at a uniform air pressure so as to give the uniform pitch and intensity of the note. By means of this the relative sensitiveness of various types of transmitters may be determined. It was found that when operated on a local battery of two volts various types of transmitters developed in the secondary and the repeating coil electromotive forces which sent through a 3,000-ohm circuit currents varying from 0.000055 ampere for a poor transmitter to 0.000465 ampere for a good one, when actuated by this instrument. An electrically driven siren is used for testing the sensitiveness of receivers to different pitches of sound. By means of it it has been found that certain transmitters are more sensitive to sounds of definite pitches and less sensitive to other sounds of different pitches, the notes and loops apparently being octaves apart. Oscillographs are used for studying telephone currents, and also various forms of ringing currents supplied by different types of ringing apparatus.—*Abstracted from the American Telephone Journal (New York), September 14.*

INDUSTRIAL SECTION

ILLUSTRATED DESCRIPTIONS OF NEW AND STANDARD ELECTRICAL AND MECHANICAL APPARATUS

The De La Vergne Kerosene Oil Engine.

The De La Vergne Machine Company, New York city, has designed and placed on the market a two-cycle, vertical engine, using kerosene or fuel oil. Fig. 1 shows a fifteen-brake-horse-power De La Vergne engine direct-connected to a ten-kilowatt generator, and Fig. 2 shows this engine with one-half in section. The air port A and exhaust port E, at the middle of the cylinder, indicate at once that the engine operates on the two-stroke cycle and is single acting; hence, in a twin-cylinder engine, the crankshaft receives in each revolution two impulses, causing the engine to run very steadily.

The engine operates without carbureter,

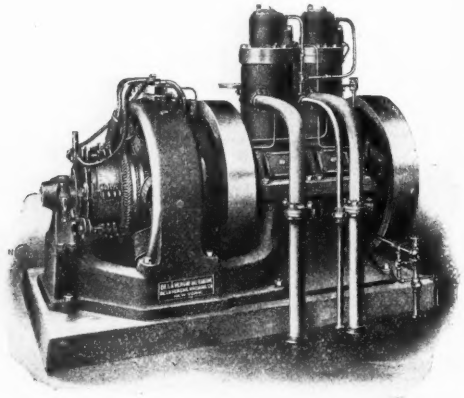


FIG. 1.—FIFTEEN-BRAKE-HORSE-POWER "DE LA VERGNE" ENGINE DIRECT-CONNECTED TO TEN-KILOWATT GENERATOR.

spark plugs or electric igniter. The cylinder head V is shaped as a bulb, kept hot enough by the successive explosions to ignite the combustible mixture. This bulb or vaporizer is made of gun iron, heated up at the start by a kerosene blow lamp.

Pre-ignitions, which cause a great deal of annoyance and loss of power, can not occur in this engine, for on the up-stroke, there is nothing but pure air in the cylinder which has entered under slight pressure from the enclosed crank case through port A. Just as the piston is reversing its motion, and not before, oil is sprayed into vaporizer V by nozzle N. The heat of the walls of the vaporizer and the hot air resulting from the high compression at once vaporize the oil and burn it rapidly, thus giving the descending piston an impulse. Just before the end of the down-stroke, exhaust port E is uncovered by the piston to let the burnt gases escape to the atmosphere. No exhaust valve is required.

It is, of course, necessary that the oil be forced into the vaporizer suddenly, at the right time and in quantity to suit the load on the engine. This is accomplished by a small plunger pump which is under the control of an ingenious and simple throttling governor fastened to and revolving with the flywheel.

There is a frame fastened with two studs concentrically to the inside of the flywheel. To the frame is hinged a cam ring, which, on the flywheel side has a projection, and back of that a cam projection, raising a roller once each revolution of the flywheel, thus moving the oil pump plunger The stroke imparted to the pump plunger is gauged by a lever pivoted to the frame. The lever is fitted with a wedge which separates the cam ring from the frame. When the engine is started the governor does not come in action until the normal speed is approached. Under light load the speed will increase when, by action of centrifugal force, a counterweight overcomes the tension of a retention spring, thus withdrawing the wedge. A spring always keeps the roller in contact with the cam ring, and when the wedge is withdrawn the pump plunger can not be actuated and no oil will be injected.

The two concentric slots in the frame allow of making an adjustment when it is desired to greatly change the normal speed of the engine. For smaller speed variations a spring can be shifted in holes in the lever. The close regulation obtained with this governor and the high rotative speed make this engine admirably suited to electric work.

All oil cups have been eliminated, oil being supplied to the cylinders and all bearings, except, of course, the wrist pin, from one forced feed central oiler actuated from the crankshaft. After the oil reservoir is filled for the day, oiling requires no more attention.

A peculiar as well as commendable feature of this engine is the provision for water-cooling. A small rotary pump driven by spur gear on the shaft circulates the water first through this crank case and around to the bearings; then through the two cylinder heads around the spray nozzle. This cooling prevents heating up of the air aspirated into the crank case, and keeps down the temperature of the lubricating oil and that of the bearings.

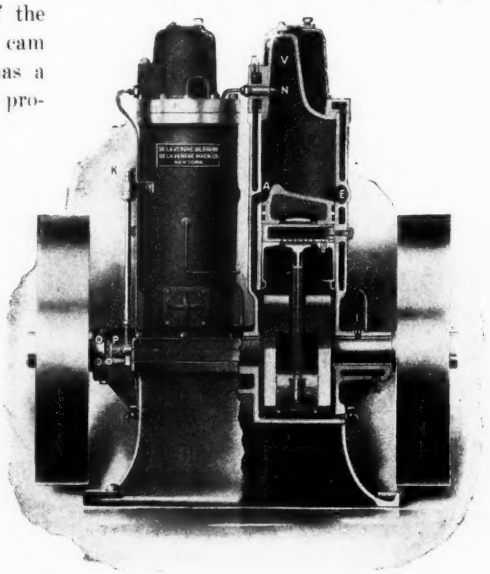


FIG 2.—SECTIONAL VIEW OF TWIN-CYLINDER VERTICAL OIL ENGINE.

It represents quite a departure from the usual design. The two outer shaft bearings and the lower half of the centre bearing are carefully lined with special bearing metal. The upper half of the centre bearing is of phosphor bronze; it unites the two cylinders and makes the joint air-tight. Bronze spring packing rings are used in the outer bearings to prevent loss of air or of lubricating oil along the crankshaft. All bearings are bored and scraped to fit shaft.

The engine is devoid of all complex mechanism; all parts are accessible; its design is easily understood; it can therefore be readily operated by any one without previous experience. For marine work the stationary base is omitted. The fifteen-brake-horse-power weighs, complete, 1,180

pounds; the seven and one-half-brake-horse-power (single cylinder), 750 pounds; dimensions of cylinder, seven by seven and one-half inches; normal speed, 450 revolutions per minute. Other sizes are under construction. The engine can be run in either direction without changing any part. Every engine is tested at the works as to power developed, regulation and economy of fuel. The combustion is said to be so perfect that no carbon is deposited in the cylinder and the vaporizer need not be cleaned oftener than twice per year, if the engine is run on kerosene.

Jeffrey Mining Machines.

The Jeffrey mining machines with flame-tight motors and starters shown in the accompanying illustrations were brought out almost simultaneously with the publication of the British departmental committee's report upon the use of electricity in mines. This report, which embodies rules for the use of electricity in mines, recommended the adoption of entirely enclosed motors and auxiliary devices, such as starters, terminals, etc., for all mines coming under general rule No. 8 of the Coal Mines Regulation act of 1887.

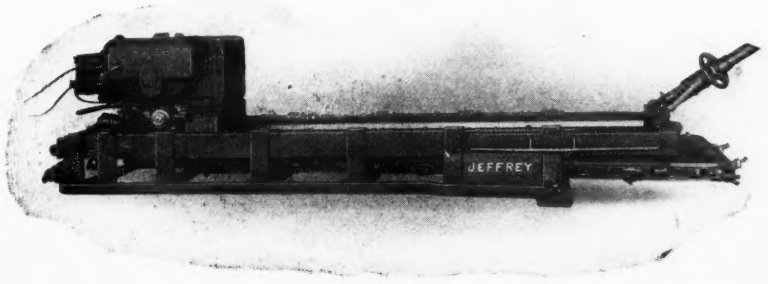


FIG. 1.—JEFFERY 21-A COAL-CUTTER EQUIPPED WITH ENCLOSED TYPE MOTOR.

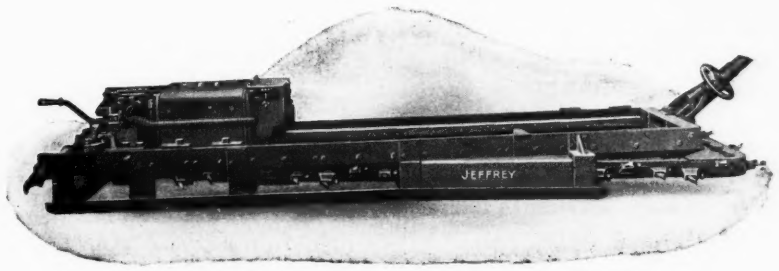


FIG. 2.—JEFFERY 27-A COAL-CUTTER FOR LOW-VEIN MINING.

Mining-machine motors of necessity have to be designed to be very compact. It is therefore necessary that every advantage be taken of space, so that the motors will not heat excessively under their regular duty. In this country, where our mines are very free from gas, the open type of motor has found favor on account of its accessibility, and on account of the fact that the same motor capacity can be put into smaller space in the open type than in the enclosed type. By careful designing, however, the Jeffrey Manufacturing Company, of Columbus, Ohio, has been able to put upon its mining machines motors of the enclosed type which are of equal capacity to those of the open type formerly used, and the enclosed motors occupy practically no more space than those of the open type.

The Jeffrey 21-A mining-machine motor, which is typical of other enclosed mining-machine motors made by this company, is a modern motor in every respect. The armature is drum-wound, with machine-formed coils. The pole pieces are of laminated sheet steel, and the windings of both the armature and field coils are insulated in the most approved manner for mining-machine service. This service, by the way, is probably the most severe of any service which electric motors are called upon to perform. The insulation has to withstand both oil and moisture, as well as heat, and infinitely more dirt and less attention than in any other service known. The motors illustrated are provided with self-oiling ring-oiling bearings, which are so arranged that the oil hermetically seals the motor so that any gas which may accumulate about the motor can not possibly be ignited by sparking at the brushes, or any interior trouble with the motor. Over the commutator of this motor is a plate-glass door, protected by a heavy malleable-iron lid. Through the plate-glass door the brushes may be observed without opening the motor to mine gases.

The starting switch for this motor is protected in a similar manner to the motor itself, all contacts being hermetically sealed in flame-tight metal casings.

The inspector for the British government who recently inspected these motors pronounced them as conforming in every particular to the rules and requirements of the departmental committee.

An advantage of these motors in that they can be applied directly to Jeffrey mining machines with no other change than the removal of the existing open-type motors. They are wound for standard voltages of 220, 250 and 500 volts, and may be wound special for other voltages where requirements demand it.

The Jeffrey Manufacturing Company has not only brought out the 21-A motor for what is commonly designed as the standard type of chain-breast machine, but it has also brought out the 27-A motor, which is a motor of the enclosed type conforming strictly to the mining laws, which is adaptable to low or thin-vein machines. The demand for such machines equipped with both of these motors has been very extensive, and since the motors were put on the market, machines thus equipped have been ordered by the largest coal companies, not only in Great Britain, but in the English colonies where the rules of the home government are effective.

Fig. 1 shows the 21-A coal-cutter equipped with enclosed-type motor, and Fig. 2 shows the 27-A coal-cutter, which is a low-vein machine equipped with enclosed motor.

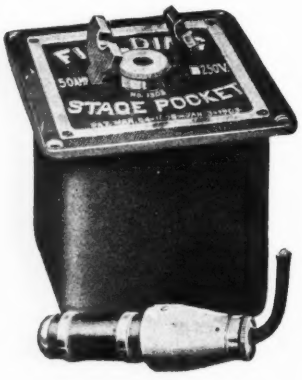
Wireless Telegraph in China.

The German Government has established a wireless telegraph station at Tsingtau, China. The station is on top of the Diederichs hill, 328 feet high, next to the signal station. The system in use is "Telefunken," of Slaby-Arco, with a mast and counterpoise, the distance of activity being about 100 nautical miles The direction of the main wave activity is southeast; however, the directions from east to south are fairly free. The station is the property of the Kiaochow Government, and is used to communicate with men-of-war of the German navy, but will be thrown open for general public use before long on conditions which have not as yet been determined.

The "Fielding" Sectional Mica Plug and Receptacle.

The accompanying illustration shows the "Fielding" sectional mica plug and receptacle, placed on the market by Stanley & Patterson, 23 Murray street, New York city. This plug and receptacle have been designed for carrying a heavy volume of current for charging storage batteries, automobiles, etc., and for distributing power for portable motors, marine work, switchboard work, theatre stage work and similar adaptations.

The feature of peculiar interest is the utilization of a sectional mica construction. A steel mandril or centre shaft is securely riveted into a threaded copper cap, dry mica discs or washers being threaded upon this mandril until about nine-sixteenths of an inch of these mica discs has been built up. Upon this built-up construction a pure copper disc three-eighths of an inch thick is set in place. Upon the copper disc other mica discs are placed for about two inches more, when the second copper disc is set. These two copper discs are connected to terminals at the top of the plug by rods of copper screwed into the discs on a taper and riveted securely. The lower end of the plug is capped with a heavy rounded bronze casting after the mica discs have been compressed under hydraulic pressure and locked in position by a strong lock pin. This cap acts solely as a protection crown piece. The last operation on the plug is to put it into a lathe and turn

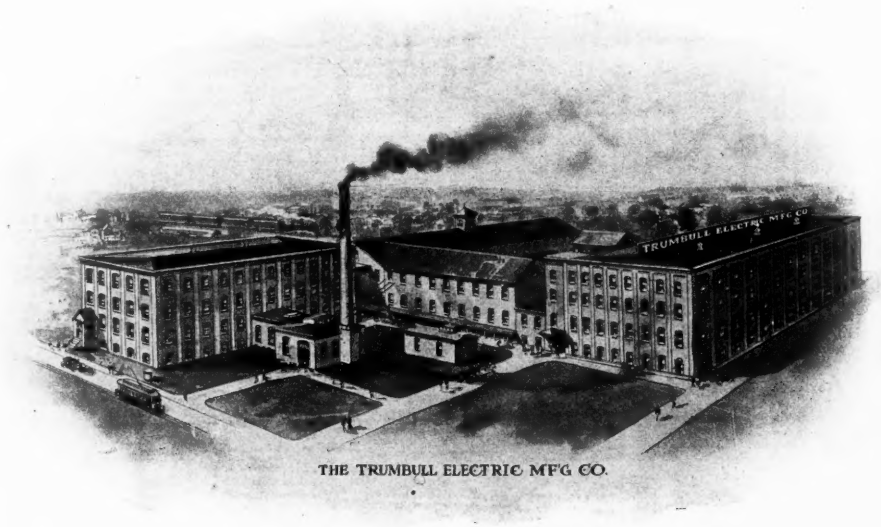


"Fielding" Plug and Receptacle.

the mica down with a diamond tool until it is perfectly smooth and round. The hydraulic pressure is so great that, when turned down, the mica surface of the plug has the appearance of rawhide, and, when finished, is proof against mechanical injury.

A fine heavy glazed block of white "Imperial" porcelain, four inches by six inches, forms the base of the receptacle. Into the heavy porcelain block there are mounted two split-spring contact rings. The contact rings will readily carry 200 amperes without the slightest heating. Removable copper lugs are provided, not only on the receptacle proper, but also in the head of the plug. A steel disc protects the porcelain block from injury should the block be driven home with undue force. Between this steel disc and the upper steel plate a heavy rubber gasket is interposed. This effectually prevents any dampness from getting into the receptacle.

This plug and receptacle has been approved and listed by the Board of Fire Underwriters.



Works of the Trumbull Electric Manufacturing Company, Plainville, Ct.

The Growth of the Trumbull Electric Manufacturing Company.

The completion and occupancy of another new factory building by the Trumbull Electric Manufacturing Company at Plainville, Ct., marks the rapid development of this company, which makes a specialty of producing an extensive line of switches and switch parts. It was in the issue of January 13, 1906, that the Electrical Review published a historical review of this company's plant. This marked the completion of an extensive addition, and the fact that another structure, larger than the one there described, has been necessary to meet the demands for turning out the company's product, indicates the popularity with which the material has been received by the trade.

The company was organized February 1, 1899, by Frank T. Wheeler, John H. Trumbull and Henry Trumbull, acting as president, secretary and treasurer, respectively. These gentlemen occupy the same positions to-day.

The space originally occupied by the old factory is now used as a storeroom for copper and brass, where a supply of 200,000 pounds is carried in stock. In 1901 a building was added to the plant and the manufacture of type "B" switches commenced. This building is now used as a receiving room and storeroom. Late in 1905 the large four-story brick addition above referred to was erected.

The new factory building, which will be noticed at the extreme right in the illustration herewith, is a fine example of modern mill construction. This new section about doubles the capacity of the plant. The basement is used to store slate of various sizes used in the construction of switch bases. From 150,000 to 200,000 pieces are carried in stock. On the first floor are located the machines for drilling the slate and marble pieces for the panel switchboards. The second floor is devoted to the construction of switchboards and panel-boards, and to the construction of iron switch boxes. The third floor is devoted to the assembly of porcelain material, such as combination switches, plug cutouts, New Code cutouts, etc. There is also a department on this floor for cabinet-making and wooden panel-box manufacture. The fourth floor is at present used as a storeroom.

Asbestos Wood.

The Asbestos Wood Company has placed on the market a non-inflammable substitute for wood which may be framed, molded and worked with ordinary wood-working machinery, to take the place of slate or marble for switchboards and for all electrical purposes. This asbestos wood is manufactured under patents granted to Professor Charles L. Norton, of the Massachusetts Institute of Technology.

Asbestos wood is a substance made from asbestos fibre and a certain kind of cement. This new material is harder than wood, even oak or maple, and takes a higher polish than either. Its strength, as measured by subjecting boards forty-eight inches in length and twelve inches in width to a centre load, shows that it has a fibre strength under transverse load of about 3,500 pounds, being therefore two-thirds as strong as pine wood; while it weighs about seventy-five per cent more than maple or oak.

It is practicable to make boards of considerable width, at least up to thirty-six inches, because of lack of tendency of this material to split. Asbestos wood has also a much less pronounced tendency to warp than has either soft or hard wood. Like ordinary wood, it is somewhat weaker when wet than when dry, but it recovers its original strength upon drying. Several specimens that were exposed to the weather upon a roof close to the Massachusetts coast through the winter of 1905-1906 changed their dimensions so little that while they could be slipped again into the molds in which they are made, they fitted so closely that the molds could be lifted by the friction of the piece upon the sides of the mold.

Asbestos wood is sufficiently porous to take paint and varnish readily. There is nothing in its composition to act upon linseed oil or oleo-resinous compounds, except to cause them to dry a little faster. Nearly every varnish, stain or filler of standard use upon wood has been tried upon the asbestos wood with satisfactory results, at least as far as could be determined in a period of observation lasting for about one year.

The wood has been shown to be a good non-conductor of heat, and has nothing whatever in it which can burn.

As the result of severe fire-resistance tests of the new material, made at the factory of the Asbestos Wood Company, at Nashua, N. H., on March 27, the following conclusions have been reached: 1—The wood stands exposure to fire of long duration without noticeable warping or distortion or weakening. 2—The subsequent action of water does not cause the wood to disintegrate, merely softening its surface. 3—The asbestos wood door is sufficiently efficient as a fire door to act as a certain means of isolation in house or hotel rooms, and looks as well as a painted wooden door. 4—The asbestos wood is an exceptionally good non-conductor. 5—The stock was cut to size with the usual circular saws, and planed and jointed on ordinary planers. It would seem to establish the claim that the material, while of great fire resistance, can be worked as wood is worked and used for the purposes for which wood is used.

With regard to the adaptability of asbestos wood as an insulating medium, its ability to withstand high voltages has been shown by a number of tests on pieces about one-half an inch in thickness. The following results have been announced: A specimen eleven-sixteenths of an inch thick showed a resistance of 6,300 megohms. Three specimens, each five-eighths of an inch thick, showed 30,000, 70,000 and 100,000 megohms resistance, respectively. Three other specimens, one-half inch, five-eighths inch and one and one-half inches in thickness, showed puncturing voltages of 36,000, 48,000 and 56,000, respectively.

The short fibres which have been found by Professor Norton to be particularly adapted for asbestos wood are found in the town of Blake Lake, on the line of the Quebec Central Railroad, about eighty miles from the city of Quebec. These properties are principally owned by the American Asbestos Company, of which Henry M. Whitney, the president of the Asbestos Wood Company, is president and principal owner. The Asbestos Wood Company has offices in the International Trust Company Building, Milk and Devonshire streets, Boston, Mass.

A New Insulating Varnish.

The Benolite Company, Pittsburg, Pa., has placed on the market a new insulating varnish known as "Benolite." This varnish is said to have high dielectric strength and great flexibility. One of the interesting qualities of this varnish is that it contains no linseed oil, nor does it depend upon China wood oil for its characteristics. It contains no metal driers or oxides, and is free from destructive elements and acids which might corrode copper or cloth.

The Benolite varnish is made in several different forms, one of the most important of which is the black insulating varnish. This material applied to insulating tape or cotton-covered wire can be dried in six to eight hours at 212 degrees Fahrenheit, giving a hard, glossy surface. Baking for 192 hours at this temperature produces no apparent change in flexibility.

The Benolite black air-drying varnish is also proof against strong acids, alkalies and destructive salts.

The following tests were made with B-B-B cambric, with two dips of Benolite, the first being baked two hours, the second dip baked sixteen hours, both bakings at 100 degrees centigrade:

Test No.	Breakdown Volts.	Mils Thickness.	Volts per Mil.
No. 1	14,200	12.0	1,183
No. 2	14,800	14.0	1,057
No. 3	16,000	14.5	1,104
No. 4	16,600	15.0	1,106

The New "American" Portable Relay.

In addition to its well-known line of ammeters and voltmeters for both portable and switchboard work, the American

"American" Portable Relay.

Instrument Company, of Newark, N. J., has recently developed an exceedingly sensitive yet rugged and reliable portable relay; and these instruments are built on the same principle as the regular type of "American" voltmeter, having a movable coil mounted in jewel bearings, in such a way that it can turn between the poles of a powerful permanent magnet. Instead of the usual pointer, a short platinum contact arm is attached to the moving coil. On each side of this contact there is mounted an adjustable platinum contact point, so that a local circuit may be closed when the moving arm is deflected to either one side or the other of its normal position. The instru-

ment may be closely adjusted, so that, within reasonable limits, any desired movement of the contact arm can be provided for.

At maximum sensitiveness this relay requires 0.000000002 watt to actuate it, this being 0.0000002 ampere and 0.001 volt potential difference. The resistance of the instrument usually supplied is approximately 500 ohms. This relay will find a large field of usefulness in connection with wireless telegraphy and similar branches of electrical service.

James G. Biddle, 1114 Chestnut street, Philadelphia, Pa., is general sales agent of the American Instrument Company.

Amalgamated Copper Subsidiaries Cut Copper Output Fifty Per Cent.

The directors of the subsidiary companies of the Amalgamated Copper Company, including the Boston & Montana, Anaconda, Butte & Boston, and Parrot, held a meeting on the afternoon of Wednesday, September 18, and after a careful discussion of the situation, agreed to curtail the output of the mines fifty per cent or more from the normal production. The exact curtailment will be agreed upon by the officers of the respective companies, and will be commensurate with the copper situation.

An official statement has been made that if conditions grow less favorable, the decrease in production will be more than fifty per cent. On the other hand, if the market shows improvement, the output will be increased accordingly. In view of the fact, as has already been stated in the ELECTRICAL REVIEW, that the consumers have very small supplies of copper on hand, it is expected that the conditions will immediately improve. It has been frankly admitted by the Amalgamated Copper Company that there has been very little buying of copper, and that the stocks on hand were increasing. The increase in carrying charges on continually accumulating stocks was one of the main reasons for the decision to curtail the output. The situation has rather changed from the usual, in that the producers are now carrying the stocks, instead of the consumers.

It is stated that at the meetings of the Amalgamated company's subsidiaries next month the dividends of all the constituents will be reduced from forty to fifty per cent. It is expected the directors of the Amalgamated Copper Company will declare a dividend of about one per cent for the quarter, as compared with two per cent in the previous quarter. The Anaconda dividend will be $1 or $1.25 a share for the quarter, as compared with $1.75 in the previous quarter. The Boston & Montana, about two months ago, declared a quarterly dividend of $2 a share and $10 extra. The dividend at the meeting next month will probably be fifty per cent less.

Consolidation of Chicago Edison Company and Commonwealth Electric Company.

The Chicago Edison Company and the Commonwealth Electric Company were formally consolidated at stockholders' meetings on September 16. All of the stock of the Commonwealth company and over ninety-five per cent of the stock of the Chicago Edison Company was represented at the meetings. At each meeting the vote was unanimous for consolidation. The name of the merged companies will be the Commonwealth Edison Company, and headquarters will be, as heretofore, in the Edison Building, 139 Adams street, Chicago.

The Commonwealth Edison Company will have a capital stock of $30,000,000, and will operate under the Commonwealth franchise, which covers the territory of the city of Chicago and has still nearly forty years to run. The officers of the company remain as follows: president, Samuel Insull; first vice-president, Robert T. Lincoln; second vice-president, L. A. Ferguson; secretary and treasurer, W. A. Fox; purchasing agent, R. C. P. Holmes. The members of the first board of directors of the Commonwealth Edison Company are: Henry A. Blair, Edward L. Brewster, Joseph Leiter, Robert T. Lincoln, John J. Mitchell, Erskine M. Phelps, A. A. Sprague, Lambert Tree and Samuel Insull.

City of St. Charles, Mo., Wants Electric Street-Car System.

St. Charles, Mo., is a thriving and prosperous city with over 12,000 inhabitants. It has no street-car system, although connected by electric lines with St. Louis, Mo., a distance of twenty miles. The general prosperity of the city has caused one addition after another to be laid out and subdivided, and it now seems as if a street-car system in the city would be a profitable enterprise. The city council is ready to grant a trolley franchise to any corporation to construct and operate a system within the city. The city clerk is Charles H. Kansteiner.

Chicago to Adopt Nickel-in-the-Slot Cars.

Three hundred new street cars provided with slot machines for the automatic collection of fares will be put in service by the Chicago City Railway Company next month. The new cars will be provided with a wide rear platform, so as to afford facilities for getting on and off. The rear platform is divided by a rail in the centre into two passageways, the one on the right for the use of passengers boarding the car, and the one to the left for those alighting. The front platform of the car is to be used for exit only. The door at that end of the car closes automatically when the car starts.

Another innovation of great importance to be inaugurated by the Chicago City Railway Company is a new method of dispatching and the adoption of a system of running the cars by telephone orders instead of from a central dispatching office and an inflexible schedule. This will make it possible to transfer cars from one line to another.

The Fall Meeting of the American Electrochemical Society.

The fall meeting of the American Electrochemical Society will be held in New York city, at the Chemists' Club, 108 West Fifty-fifth street, October 17, 18 and 19. The preliminary programme has been announced as follows:

Thursday, October 17—7 P. M., meeting of the board of directors, meeting ladies' committee, reception at Chemists' Club; 8.40 P. M., lecture on "The Diamond and Moissanite," by Dr. George F. Kunz; 9.30 P. M., lecture entitled "Deflocculated Graphite," with experiments by E. G. Acheson.

Friday, October 18—9 A. M., reading and discussion of papers; special feature, electrometallurgy of iron and steel; 12.30 P. M., lunch at Hotel Cumberland, Fifty-fourth street and Broadway; 1.30 P. M., excursion to laboratories of Thomas A. Edison; 7.30 P. M., subscription dinner, Liederkranz Hall, Fifty-eighth street, near Fourth avenue, $5 per cover.

Saturday, October 19—9 A. M., reading and discussion of papers (meeting to be held at Columbia University); 1 P. M., lunch at Hotel Cumberland; 2 P. M., excursion to the Long Island City power plant of the Pennsylvania Railroad and other points to be announced later; 8.30 P. M., smoker tendered to the society by the Chemists' Club.

Current Electrical News

DOMESTIC AND EXPORT.

MEXICAN LIGHT AND POWER—The new issue of preferred stock, amounting to $2,400,000, made by the Mexican Light and Power Company has been underwritten by a syndicate and will not be offered to the holders of the common stock.

GUANAJUATO STREET-CAR LINES TO BE IMPROVED—The street railways of Guanajuato, Mexico, are to have improved service. The directors have decided to spend $50,000 in betterments, and rails will be laid on many new streets. The deal to purchase the street railways within the city limits by an American syndicate for $500,000, is declared off, and the old company will improve the lines, rolling stock, and general service. Since the inundation some two years ago very few repairs or improvements have been made.

SOUTHERN PACIFIC'S SAN FRANCISCO SUBURBAN LINES TO BE ELECTRIFIED—Contracts have been let for the electrification of the Southern Pacific's suburban lines around San Francisco, Cal. The heavily increased traffic on these lines made this change advisable. The contracts for the first part of the work have been let under the supervision of A. H. Babcock, the Southern Pacific's electrical engineer. The aggregate amount involved in the contracts is about $900,000. The Alameda line will be electrified first, and later the other lines around San Francisco, including the Berkeley, Oakland and Fruitvale lines.

SCRANTON ELECTRIC COMPANY BOND ISSUE—The Scranton, Pa., Electric Light and Heat Company, which is controlled by the American Gas and Electric Company, Philadelphia, Pa., has sold $1,500,000 improvement bonds to a New York banking house. This is part of an authorized issue of $10,000,000 bonds, the balance of which may be issued from time to time for improvements. The proceeds from the $1,500,000 bonds just sold will be used to reimburse the American Gas and Electric Company for advances made for improvements and extensions to the Scranton property, which has placed it in the position of being the most important and up-to-date of all the properties controlled by the American Gas and Electric Company.

PLAN $1,000,000 CAR LINE—United States Senator S. B. Elkins, Colonel Richard O. Kerns, ex-Senator Henry Gassaway Davis, of New York, and Stephen B. Elkins, Jr., of New York, have secured a charter for a trolley line through the counties of Taylor, Barbour and Randolph, in West Virginia, to be connected with the Morgantown, Fairmont & Mannington line, which is to be extended to Wheeling, and then run direct to Pittsburg, Pa. The new road will open a trolley service in the most valuable sections of West Virginia and Pennsylvania. The road will cost close to $1,000,000, and with the connections will make a trolley route worth five times that much. Among the most important cities in the interior to be connected are Grafton and Elkins, the latter the home of Senator Elkins, Davis and Kerns. The name of the new company is the Elkins Light and Power Company and the chief office will be located at Elkins.

TROLLEY EXPRESS BUSINESS PROFITABLE—It is announced that about October 1 the New Haven road will put into general operation its trolley express system on its 1,000 miles of electric lines throughout the three southern states of New England. At present on several lines this express service has been successfully established, but it has been in widely separated districts and in no way general. President Mellen has for some time been perfecting plans for a general freight and package service over the electric network which covers Massachusetts, Connecticut and extends into Rhode Island. This electric express service is to act as a feeder and distributing medium for the steam lines. In New Haven county the trolley express has been given a thorough trying out and has been a great accommodation to the public as well as a paying investment for the management. At first a private company handled the business under lease. Later the trolley management took it over.

PENNSYLVANIA TROLLEY MERGER—With the merger of the electric railway companies in York county, Pa., the Wrightsville & York Street Railway Company, of which ex-Judge W. F. Bay Stewart is president, has filed notice of an increase of its stock from $66,000 to $3,397,000. It is announced that the Wrightsville & York Company, the most important to be included in the merger, will thus be the medium through which the capital will be provided for improvements and extensions contemplated. At least $3,000,000 of the increase will be available for this purpose. The trolley companies to be included in the merger are the York, Wrightsville & York, York & Dallastown, Red Lion & Windsor, York Haven, York & Dover and Hanover & York Street Railway Company. The consolidation will be termed the York Railways Company. Aside from the completion of the York & Hanover line, it is at present proposed to extend a line into Harrisburg and double deck the Pennsylvania Railroad bridge at Columbia to provide a connecting link with Lancaster county. The stock limit of the company is $6,000,000. Preferred stock will be issued for the first time to the amount of $1,600,000.

NEW 160-MILE KANSAS TROLLEY—Work has begun on a 160-mile freight and passenger electric line from Independence to Kansas City, Kan., by way of La Hunt, Neodesha, Altoona, Chanute, Iola, Ottawa, Baldwin, Lawrence, Tonganoxie and Bonner Springs. It is expected to have the new line in operation over the entire 160 miles at the end of fifteen months. The Midland Construction Company, organized three months ago with $4,000,000 capital, is to build the road. It is made up of New York and Minneapolis men. W. L. Moyer, formerly president of the National Shoe and Leather Bank, New York, is president, J. F. Luce is vice-president of the company, Howard S. Dudley is secretary, and J. E. Martin is treasurer. These officers are Minneapolis business men. The new line has been surveyed from Independence to Iola, sixty miles. A preliminary survey of the remainder of the 160 miles has also been made. The route of the proposed line has been graded from Independence to La Hunt, ten miles. In La Hunt are two large cement companies having a combined capacity of 10,000 barrels a day. The new road will connect with the Kansas City-Western Electric Line Company.

WESTERN PACIFIC RAILROAD INTERESTED IN WESTERN POWER COMPANY—The Western Pacific Railroad Company is behind the Western Power Company, which will soon build one of the largest electrical power generating plants in the West. It is the intention of the Gould interests to construct a network of electric lines throughout the state of California. Regarding the purposes of the Western Power Company, so far as they refer to Oakland, H. P. Wilson, of the firm of Brown & Wilson, says the company has purchased a tract of seven acres on Sessions Basin, on which an immense power plant will be built at a cost of $2,500,000. This will be an auxiliary station, independent of the long-distance transmission, and is designed to furnish power if accident should interrupt communication. In eight months the auxiliary will supply 50,000 horse-power. By October 1 of this year 50,000 horse-power will be transmitted from Great Bend on the Feather river, over 140 miles. With the auxiliary the company will have a horse-power capacity of 100,000 by May, 1908, one-half of this amount being derived from Great Bend. Work on the buildings on the estuary will be commenced immediately, and pushed to completion. Contracts have been let for turbines, generators, boilers and all other machinery required.

TO EXTEND TELEPHONE LINES—To care for the extensions made necessary through the rapid development of its business, the stockholders of the Citizens Telephone Company, of Grand Rapids, Mich., at the annual meeting voted an increase in capitalization

from $3,000,000 to $3,500,000. The statistics for the fiscal year closing June 30 last show a net gain of instruments in the local exchange for the year of 1,015 and in the outside exchanges of 1,424. For the city this is the second largest gain in the last ten years and the indications are that the coming year will show equally well. With 100,000 feet of conduit the largest extension of the underground system was completed. Within five years the gross earnings have increased from $274,343.79 to $559,908.73 and there have been disbursed the last year dividends amounting to $203,399.71. The proportion of gross expense to gross income has decreased within ten years from seventy per cent to fifty-one per cent. There was an increase of dividends this year of $34,000 and $15,000 was carried to surplus. Of the present capitalization all but $150,000 is in the hands of investors. The addition to the investment of the company in this city during the year aggregated $130,380.61. Since the company began business it has disbursed $846,781.74 in dividends. These directors were chosen, the only change being the selection of John B. Martin in place of E. G. Studley: Charles F. Rood, E. B. Fisher, L. J. Rindge, J. B. Ware, Philip Graham, G. W. Perkins, W. J. Stuart, Cyrus E. Perkins, Edward Fitzgerald, Robert D. Graham and John B. Martin.

NEW INCORPORATIONS.

DAVENPORT, IOWA—Davenport-Manchester Interurban Company. $15,000.

OMAHA, NEB.—Standard Electric Company. $25,000. Incorporators: Edward and Julia Schurig and C. V. Brock.

AUSTIN, TEX.—Del Rio Telephone Company, of Del Rio. $30,000. Incorporators: T. S. Sharpe, W. C. Johnson and L. Rust.

MADISON, WIS.—Goodrich Telephone Company, Goodrich, Taylor county. $3,000. Incorporators: John Kraemer, E. M. White and F. M. Perins.

MADISON, WIS.—Pardeeville Telephone Company, Pardeeville, Columbia county. $4,000. Incorporators: Frank H. Smith, Lyell V. Smith and Mina Smith.

SYRACUSE, N. Y.—The Interurban Electric Express Company. $5,000. Directors: Harry J. Clark, W. W. Foster, of Syracuse, and Harold C. Beatty, of Skaneateles.

MILWAUKEE, WIS.—The Brush Creek Farmers' Telephone Company, Ontario, Vernon county. $3,000. Incorporators: J. O. Hoff, P. A. Pederson and L. Olson.

GUTHRIE, OKLA.—The Granite Electric Light and Power Company, of Granite. $10,000. Incorporators: K. C. Cox, H. J. Hayes, A. Hindert, Addison Hall and T. S. Wilcox.

AUGUSTA, ME.—Monterey Hydro-Electric Power Company, Ellsworth. $5,000,000. President, Perry Langley; treasurer, M. F. Doyle; clerk, W. E. Whiting, all of Ellsworth.

GUTHRIE, OKLA.—The Texhoma Electric Light, Water and Ice Company, of Texhoma. $15,000. Directors: J. J. Osborne and A. W. Mason, of Texhoma, and John Houser, of Stratford, Tex.

HARRISBURG, PA.—People's Mutual Telephone Company, Riceville. $10,000. Incorporators: Jesse Martin, Riceville; T. L. Dobbins, Lincolnville; A. Burrows, Tillotson; Albert Beakeslee, Matthew Merchant, Riceville.

SAN FRANCISCO, CAL.—El Dorado Power Company. Formed for the purpose of utilizing water for the generation of electricity. $1,000,000. Directors: Paul A. McCarthy, F. H. Curry, A. B. Weiler, R. K. Barrows and C. H. Patterson.

EASTON, PA.—Henry Light, Heat and Power Company, of Lehigh township. $1,000. Incorporators: N. E. Kemmerer, Adam Henry, Tilghman Henry, James M. Henry and Albert L. Henry, all of Danielsville.

COLUMBUS, OHIO—The Southern Ohio & Tristate Independent Telephone Company, Cincinnati. $50,000. Incorporators: Thomas V. Sullivan, D. C. Collins, Jr., George H. Kolker, A. J. Koch, John Eggers and J. P. Bliss.

HOT SPRINGS, ARK.—Consumers' Electric Company. To furnish service to those portions of the city of Hot Springs not supplied at present by the Hot Springs Water, Gas and Electric Light Company. $100,000. Incorporators: Atwood Beriton, of Kansas City; M. A. Eisele and J. A. Stallcup, of Hot Springs.

MOBILE, ALA.—Citronelle Light and Power Company, of Citronelle. To build, equip, maintain and operate an electric light and power plant in the city of Citronelle. $25,000. Incorporators: J. A. Shannon, S. E. Shannon and H. H. Orr, all of Hattiesburg, Miss. Officers: J. A. Shaw, president; S. E. Shannon, secretary and treasurer.

SPRINGFIELD, ILL.—Danville & Southeastern Railway Company, with principal offices in Danville. To be constructed from Danville to the southeast corner of Georgetown township. $10,000. Incorporators (officials of the McKinley Interurban Syndicate): W. H. Carhappen, B. E. Bramble, George M. Mattis, Charles Zilly and C. E. Cox, all of Champaign.

RALEIGH, N. C.—Horseford Power Company, of Hickory; for the generation of electricity for power and lighting purposes; $25,000; incorporators, A. A. Shuford, J. D. Elliott and others. Goodwill Telephone Company; to construct telephone lines from Stokesdale to Belews Creek, Kernersville and other points; $2,000; incorporators, George M. Teague and others.

BELVIDERE, ILL.—The Interurban Express Company, Belleville. To conduct an express business over all the lines of the East St. Louis & Suburban. $50,000. Directors: Henry Wrape, Joseph Saunter, H. M. Dittoe, B. B. Harris and J. F. Johnston. Officers: Henry Wrape, president; Joseph Saunter, vice-president; H. M. Dittoe, secretary and treasurer, and J. F. Johnston, manager.

MONTPELIER, VT.—Sharon Power Company, of Sharon. Organized for the purpose of leasing or acquiring reservoirs, flumes, pipe-lines and dams for the utilization of water powers and for the transmission of electric power for lighting, heating, etc., and to utilize such power for drilling, smelting, etc. $50,000. Stockholders: James Tyson, of South Strafford; August and G. Maurice Heckscher, of New York city, and Frank A. Berthold, of New York city.

JEFFERSON CITY, MO.—The St. Joseph, Excelsior Springs & Lexington Railway Company. To construct and operate a standard gauge electric road from Excelsior Springs to Vibbard, a distance of six miles, and subsequently to Lexington. $200,000. Incorporators: Dr. G. P. Lingenfelter, of Denver; S. S. McIntire, C. D. Wale and A. M. Bates, of Excelsior Springs; W. J. Bates, of Vibbard; Charles Dyer, of Denver; David C. Finley, of Kansas City.

TOPEKA, KAN.—The Independence North & South Railway. For the purpose of constructing a railroad, telegraph and telephone lines, together with electrical power plants, the road to extend from Kansas City, Kan., to Caney, Kan., through the counties of Wyandotte, Douglas, Johnson, Miami, Coffey, Anderson, Linn, Woodson, Allen, Bourbon, Wilson, Neosho, Chautauqua, Montgomery and Labette. $10,000. Directors: C. A. Leeds and F. C. Daniels, of Kansas City; H. F. Guthrie, E. H. Ware and J. L. Hunt, of Topeka.

LEGAL NOTE.

LAMINATED CORE FASTENING DECISION—The United States Circuit Court for the District of New Jersey has filed an opinion in the suit of the Westinghouse Electric and Manufacturing Company against the Prudential Insurance Company of America, on Nolan patent No. 582,481, granted May 11, 1897. This opinion is the outcome of a suit brought by the Westinghouse company against the Prudential company, alleging infringement of the above patent. The patent in suit relates to a means for fastening the laminæ of the cores of electrical machines together and to the casting by which they are supported, and whereby the armature can be readily taken apart and put together. Judge Lanning, in this opinion, holds that claims two and four of the Nolan patent are valid, and cover the construction found in the Bullock generator used by the Prudential company.

DATES AHEAD.

Jamestown Tercentennial Exposition. Norfolk, Va., April 26 to November 30.

Railway Signal Association. Annual meeting, Milwaukee, Wis., October 8-10.

American Street and Interurban Railway Association. Annual meeting, Atlantic City, N. J., October 14-18.

American Electrochemical Society. Fall meeting, New York city, October 17-19.

American Association for the Advancement of Science. Chicago, Ill., December.

PERSONAL MENTION.

MR. CHARLES BAILEY has accepted the position of superintendent of the Dunkirk (Ind.) electric light plant.

MR. M. D. FIELDS, claim agent of the Houston Electric Company, Houston, Tex., has resigned to become connected with the Layne & Bowler Company. He is succeeded by Andral Van.

MR. V. C. GILPIN, 120 Liberty street, New York city, has been appointed eastern agent for the Pratt Chuck Company, Frankfort, N. Y., manufacturer of electro-galvanized pressed steel contact boxes. Mr. Gilpin will carry a complete stock of this company's supplies at the New York office.

MR. GEORGE REDMAN, for a number of years a director of the National Electric Light Association, and a well-known electrical man, was one of the strong players for the Oak Hill Country Club, of Rochester, N. Y., in a golf tourney played with the Owasco Country Club, of Auburn, on September 12.

MR. C. S. STANTON, assistant electrical engineer of the Oneonta & Mohawk Valley Railroad Company, Oneonta, N. Y., has been made electrical engineer, and will have charge of all power work for the road. He succeeds J. C. Huffman, who has accepted a position as sales engineer with the Canadian Westinghouse Company.

MR. J. C. HUFFMAN has resigned from the position of electrical engineer of the Oneonta & Mohawk Valley Railroad Company, Oneonta, N. Y., to accept a position as sales engineer with the Canadian Westinghouse Company, Winnipeg, Manitoba, office. Mr. Huffman will cover Alberta, Saskatchewan and eastern British Columbia, making his headquarters at Calgary, Alberta.

MR. D. C. NEWMAN COLLINS, consulting engineer and industrial architect, 29 Broadway, New York city, has recently issued a paper which will be found of considerable interest and benefit to parties contemplating the erection of manufacturing buildings, warehouses, mills or anything in the way of an industrial plant. This is a treatise going into the details of various classes of structures, and the materials and methods employed.

MR HARRY DE STEESE, of New York city, has been appointed by the International Timber Preserving Company, of Chicago, manufacturer of the public-service timber preserver, "Neosote," as eastern representative. For sixteen years Mr. De Steese has been constantly identified with various branches of public-service work, both in this country and in Europe. His earliest experience was gained under Postmaster-General Payne, at Milwaukee, and from 1896 to 1900 he was manager of the railway department of the Western Electric Company, leaving that position to take charge of the establishment of a supply business in London, England.

ELECTRIC LIGHTING.

SCRANTON, PA.—The Scranton Electric Company is installing a 1,500-kilowatt turbine.

MAGNOLIA, ARK.—The plant of the Magnolia Ice and Electric Light Company was destroyed September 9. Loss, $20,000. Insurance, $10,000.

CONCORD, N. C.—The Southern Power Company has connected its line with the city and many of the mills of the city will be operated by electric power.

NASHVILLE, TENN.—The Southern Electric Company, of Nashville, has contracted to install a complete electric lighting plant at Ruskin, near Charlotte.

FAYETTEVILLE, W. VA.—It is stated that J. Turner Moorehead, of New York city, is interested in the development of the New river falls near Sandstone.

TRENTON, N. J.—The Upper Missouri River Power Company has filed with the secretary of state papers increasing its authorized capital from $5,000,000 to $10,250,000.

PLYMOUTH, IND.—C. D. Snoeberger, president of the Plymouth electric light plant, announces that bids will soon be in order for $10,000 worth of improvements to the system.

HAMMONTON, N. J.—The town council has made a five-year contract with the Hammonton Electric Light Company and the Hammonton & Egg Harbor City Gas Company for lighting the town.

PEORIA, ILL.—Princeton has decided to sell its electric plant, which is in bad condition. It is thought that a private company can furnish light to the city at a lower rate than that now prevailing.

FALLS CITY, NEB.—At a meeting of the city council it was decided to turn the electric light plant over to a private individual who will run the plant and furnish an all-night lighting system for $120 per month.

FORT WAYNE, IND.—The Fort Wayne & Wabash Valley Traction Company has asked for a franchise to light the city of Huntington, proposing to supply electricity from the big power station here, twenty-five miles distant.

LAUREL, DEL.—The Laurel electric light plant burned on September 22, and the towns of Laurel, Seaford, Bridgeville and Delmar are without electric light. A spark from the switchboard ignited one of six barrels of oil, which exploded.

BELLEVUE, PA.—By a vote of six to one the Pennsylvania Light, Heat and Fuel Company has been given a franchise for twenty-five years throughout the borough. Under the new ordinance the borough can not be charged over $60 a year for each arc lamp.

BOSTON, MASS.—The Malden & Melrose Electric Light Company has petitioned the gas commission for authority to issue $275,000 additional capital stock, the price to be determined by the board. Proceeds will pay floating debt and for additions to plant.

WHITEFIELD, N. H.—Dr. G. H. Morrison, of this town, has purchased a controlling interest in the Bethlehem Electric Light Company. The original cost of this plant was over $100,000. He will become its treasurer and general manager. Dr. Morrison is also treasurer and general manager of the Whitefield Electric Light Company.

BOSTON, MASS.—The trustees of the Boston Suburban Electric Companies have elected Frank A. Day, of R. L. Day & Company, and Charles W. Leonard, of Newton, to the board, succeeding William H. Coolidge and Leonard D. Ahl, resigned. These changes were made at the same time James L. Richards was elected president of the subsidiary companies.

WATERBURY, CT.—A contract has been awarded to the New England Engineering Company to install a high-tension transmission line, 22,000 volts, from Scotland Station on the Shetucket river to the main station in Norwich. The contract was awarded by the General Electric Company, of Schenectady, N. Y., and the contract price was about $25,000.

RED LODGE, MONT.—A meeting of the board of trade was held recently to take steps toward building an electric railway from Red Lodge to the Bear Creek coal mining camp, four miles away. The board voted to secure an engineer to ascertain the cost. The project will be pushed as rapidly as possible. Bear Creek has one of the largest coal deposits in the Northwest.

SCRANTON, PA.—At a meeting of the stockholders of the Lackawanna Light Company it was decided to hold a special meeting on November 12, at the offices in this city, for the purpose of voting on the proposed increase of the indebtedness from $500,000 to $2,500,000. It is understood the purpose of the increase is to make it possible to take over other companies.

SAFFORD, ARIZ.—At a meeting of the trustees, William Fonda made application for a franchise to pipe the city for water and to string electric light wires. Fonda claims that he has a well in the artesian belt that will furnish water for the entire valley and power for electric lights. If the franchise is granted, Fonda proposes to organize a company with a capital stock of $50,000.

BRISTOL, TENN.—The board of mayor and aldermen of Bristol has granted a franchise to J. B. Bumgardner, W. L. Halstead, J. D. Mitchell and other promoters of the new electric company, to operate a lighting system in the city. This is a result of the recent announcement that eastern capitalists will expend $750,000 in harnessing the power of the Holston at Fish Dam for power and lighting purposes.

ELKINS, W. VA.—The city council of Elkins, W. Va., has received a proposition from Senator Henry G. Davis, on behalf of the

Valley Improvement Company, to renew the electric light franchise, the town, by this proposition, to entirely discontinue the use of gas and use arc lights at $50 per year, instead of at $60, as at present. The name of the company will also be changed to the Elkins Power Company.

MONTPELIER, VT.—The Green Mountain Lighting and Heating Company has filed with the secretary of state articles of corporation to heat and light plants and houses in and about Burlington. The capital stock is $15,000. The subscribers are: the G. S. Blodgett Company, C. D. Ordway, J. F. Cobb, Jr., and C. Hawley, of Burlington; W. M. Spear and John F. Spear, of Charlotte, and Nichols & Parker, of Essex Junction.

COLUMBUS, GA.—A resolution has been introduced in the city council instructing the city attorney to prepare a petition to the Georgia railroad commission asking that body to reduce the price of gas, electricity and telephones in this city. Fuel gas is now sold at $1.25 and lighting gas at $1.75 per 1,000 feet. Electricity is fifteen cents per kilowatt-hour and telephones are $4 for business houses and $2.50 for private residences.

SHERBROOKE, QUEBEC—A special meeting of the shareholders of the Sherbrooke Power, Light and Heat Company was held on September 6, the object being to lay before them the offer from the city to buy out the company's plant and business. The price offered by the city was $170,000, the city to assume payment of the company's bonds. A large number of the holders of the stock were either present or represented. It was finally decided to offer to sell to the city at $190,000, the city to assume the bonds.

CARSON, NEV.—Work has been commenced on the southern extension of the power lines of the California-Nevada Electric Power Company, which will extend from Pickle Meadows, near Bridgeport, Cal., to Tonopah and Manhattan, a distance of 220 miles. This extension will include power lines into Masonic, Bodie and Aurora, which it is estimated it will require three months to complete. Within a year the company hopes to be operating its lines into Reno and Yerrington, as it has facilities for generating immense quantities of power along the Carson and Walker rivers.

HAMILTON, OHIO—Sealed proposals will be received at the office of the city auditor of the city of Hamilton, Ohio, until 12 o'clock noon on the twelfth day of October, 1907, for the purchase of $20,000 worth of electric light bonds of the city of Hamilton, Ohio. These bonds are issued in accordance and in conformity with ordinance No. 306 of the city of Hamilton, Ohio, passed on the sixth day of August, 1907, entitled, "An ordinance to issue bonds for the city of Hamilton, Ohio, for the purpose of enlarging, improving and repairing the electric light works of the city of Hamilton, Ohio."

MORRISTOWN, N. J.—The Morris & Somerset Electric Company has applied to the Morris county freeholders for permission to open roads, erect poles and string wires along the county roads through Morristown. The company, which was formed by local men as the result of the service given the town by the Public Service Corporation, has been granted a franchise. The freeholders referred the application to the road committee, which later granted the permission. The company is to file a bond for $5,000. It has requested practically the same permission from Morris township. The new company has contracted with a New York firm for the installation of its plant.

CALUMET, MICH.—A new water power company is preparing to invade the Delta county field. Representing Southern Michigan capitalists, F. E. Hatch, of Pellson, has secured an option on Boney Falls, twenty miles north of Escanaba, on the Escanaba river, and it is expected that he will acquire the rapids shortly, and will commence their development. The water here drops twenty feet in as many rods. Mr. Hatch has served notice on the Escanaba board of public works of his intention to submit a proposition to furnish power for the operation of the municipal lighting plant, as has the Escanaba Electric Power and Pulp Company, which is developing the extensive water power at Flat Rock, on the Escanaba river.

JACKSONVILLE, FLA.—The board of bond trustees has issued its twelfth annual report, which covers the year 1906, and which shows the condition and values of the city properties. In his report to the board, Superintendent Ellis shows the improvements made in the electric and water plants, and says: "The receipts from lighting and power for the past year amounted to $223,684.29, an increase over last year of $37,614.81. The cost of operating the plant was $112,965.12. The earnings of the plant were $110,719.17, of which sum $60,128.48 was expended in new machinery, boiler, transformers, meters and line extensions. The output of current for the year amounted to 4,610,493 kilowatt-hours, for which we received 4.85 cents per kilowatt-hour. The cost per kilowatt-hour of current delivered at the switchboard, based on station expenses, $71,407.79, was 1.54 cents per kilowatt-hour; based on total operating expenses, $112,965.12, it was 2.45 cents per kilowatt-hour.

ANTIGO, WIS.—Steps have been taken which will probably result in the organization of a company to develop electric power for the city of Antigo and Langlade county. Henry Sherry, of Neenah; Mayor George Hill, Nate Bruce and Postmaster Edward Cleary, of Antigo, are at the head of the movement. Mr. Sherry owns and controls the water power on the Wolf river which is known as the Gardiner dam, twenty miles east of the city. His proposition is to organize a stock company to develop this power. A concrete dam would be erected and the power used for generating electricity to be used for all purposes in Antigo. It is planned to build an electric freight line to the dam to secure for Antigo the timber which could easily be brought to that point after the erection of the dam. In all probability this line would be extended into the city and equipped for electric street-car service. The electric power secured would be sufficient to not only furnish all the electric lighting used in the city, but to furnish power for every manufacturing plant in Antigo and the vicinity.

SPOKANE, WASH.—E. P. Spaulding, vice-president and general manager of the Big Bend Water Power Company, and J. S. McKenna, engineer for that company, have asked for a franchise to string wires and lay conduits for supplying electric light and power for commercial purposes in this city. Mr. Spaulding is also president of the new Idaho Northern electric railroad, which is about to build from Kingston, Idaho, up the north fork of the Coeur d'Alene river to Pritchard Creek and to a point six miles east of Murray, Idaho, a distance of thirty-three miles, and which is planning branch lines in that part of Idaho. The franchise asked for is for fifty years. It provides that the company shall build a power plant twenty-eight miles down the Spokane river from this city and shall have installed a system capable of supplying the entire city with light and power within three years. As an earnest of good faith the company offers to deposit a $10,000 guarantee that the obligations of the franchise will be lived up to. The franchise also provides that the company shall pay the city $3,000 a year in consideration for the franchise until the net earnings give that amount at five per cent, after which the city is to be paid at the rate of five per cent on the net earnings of the company. The franchise makes a proposition to supply street lights in the city at the following rates: For each 600 lights, five-year contract, $4 a month per light (the same as is paid the Washington Water Power Company); for each 600 lights for three years, $4.50 per light a month; for each 600 lights, two-year contract, $5 a light a month.

NEW MANUFACTURING COMPANIES.

PITTSBURG, PA.—The Electric Safety Device Company, of Pittsburg, has been organized with a capital of $60,000. The incorporators are: John Murphy, James C. Gray, John A. Rogen and W. L. Murphy, Pittsburg.

ALBANY, N. Y.—The F. Alexander Electric and Manufacturing Company, of New York city, has been incorporated with a capital of $25,000. The directors are: Louis Liebes, Hannah Liebes and F. Alexander, all of New York city.

HOUSTON, TEX.—A new concern has been organized to do business in Houston, called the Electric Dry Kiln Manufacturing Company. It is the owner of a new process of drying brick, invented by E. C. Luster. A company has been chartered with a capital stock of $50,000. The following officers are in charge: C. J. Morgan, of Louisville, Ky., president; E. W. Erdman, of Chicago, vice-president, and E. C. Luster, general manager. A number of prominent business men of Houston and vicinity are stockholders.

ELECTRICAL SECURITIES.

One of the most satisfactory evidences of business activity in the stock market last week was the improvement in the investment demand. While trading was almost wholly professional, the atmosphere in general appeared to be very much clearer, and there were sounded fewer notes of apprehension regarding the present outlook. The continued good weather has greatly improved crop conditions, and with further reports concerning the poor showing by the farmers abroad, it is expected that our sales of agricultural products abroad will establish a very large credit in favor of the American producers. It is estimated that the American farmers will receive about $7,000,000,000 for their crops this season. This will, of course, turn loose an immense amount of money which will flow through every channel of industry. A rather unfortunate feature of the government's statement covering the month of August is the poor showing made by exports in comparison with imports. While the exports reached an enormous sum, there was a trade balance of only $1,800,000 in favor of exports. Despite the rumors that the business of some of the big electrical manufacturing companies was falling off, it is now announced that there has been but little let-up in the volume of new orders, at least not to the extent which was prophesied but a short time ago.

Dividends have been declared on a number of important systems among which may be mentioned the following:

Providence Telephone Company; regular quarterly dividend of 1 per cent, payable October 1. Narragansett Electric Lighting Company; regular quarterly dividend of $1 per share, payable October 1. Bell Telephone Company of Canada; regular quarterly dividend of 2 per cent, payable October 15 to stock of record September 25. Havana Electric Railway Company; regular quarterly dividend of $1.50 a share on preferred, payable October 15. Tri-City Railway and Light Company; regular quarterly dividend of 1½ per cent on preferred, payable October 1. Johnstown (Pa.) Passenger Railway Company; regular quarterly dividend of ¾ of 1 per cent, payable September 30. West End Street Railway, of Boston; semi-annual dividend of 3½ per cent on the common stock, payable October 1. Memphis Street Railway Company; regular quarterly dividend of 1¼ per cent on the preferred stock, payable September 30. Peoria Light Company; regular quarterly dividend of 1½ per cent on the preferred stock, payable October 1. Bangor Railway and Electric Company; regular quarterly dividend of 1¼ per cent, payable October 1. Michigan Light Company; regular quarterly dividends of 1 per cent on the common stock and 1⅓ per cent on the preferred stock, payable October 1. Cleveland Electric Railway Company; quarterly dividend of ¾ of 1 per cent, payable October 1. Springfield Railway and Light Company; regular quarterly dividend of 1 per cent, payable October 1. Hudson River Telephone Company; regular quarterly dividend of 1 per cent, payable October 15. Knoxville Railway and Light Company, Tennessee; quarterly dividends of 1½ per cent on the preferred stock and 1 per cent on the common stock, both payable September 30. Washington Water Power Company, of Spokane, Wash.; regular quarterly dividend of 1¾ per cent, payable October 1. Evansville Light Company; quarterly dividend of 1½ per cent on the preferred stock, payable October 1.

ELECTRICAL SECURITIES FOR THE WEEK ENDING SEPTEMBER 21.

New York:	*Closing.*
Allis-Chalmers common	8
Allis-Chalmers preferred	21¾
Brooklyn Rapid Transit	48⅛
Consolidated Gas	104
General Electric	125
Interborough-Metropolitan common	10⅜
Interborough-Metropolitan preferred	28½
Kings County Electric	110
Mackay Companies (Postal Telegraph and Cables) common	64⅞
Mackay Companies (Postal Telegraph and Cables) preferred	63⅞
Manhattan Elevated	118
Metropolitan Street Railway	45⅛
New York & New Jersey Telephone	100
Western Union	75
Westinghouse Manufacturing Company	130

The business of the Allis-Chalmers Company continues unusually large. During the month of August the company shipped out of its works 29,000,000 pounds of finished material, which filled 670 cars. The unfilled business on the books of the company has a valuation of close to $16,000,000.

Boston:	*Closing.*
American Telephone and Telegraph	108
Edison Electric Illuminating	204
Massachusetts Electric	51
New England Telephone	108
Western Telephone and Telegraph preferred	60

Directors of the American Telephone and Telegraph Company have declared the regular quarterly dividend of 2 per cent. The dividend is payable October 15 to stock of record September 30. Books close October 1 and reopen October 14, inclusive. At the regular monthly meeting of the directors of the company the following statement of net earnings for the nine months to end September 30 was read: Balance for dividends, $10,960,000; dividends, $7,893,000; surplus, $3,067,000. The figures for the nine months are partly estimated, but they have been conservatively estimated and will probably exceed the balance for dividends of $10,960,000.

Philadelphia:	*Closing.*
Electric Company of America	9
Electric Storage Battery common	46
Electric Storage Battery preferred	46
Philadelphia Electric	7⅝
Philadelphia Rapid Transit	21½
United Gas Improvement	86⅛

The Philadelphia Rapid Transit Company's report for the year ended June 30, 1907, is as follows: Gross, $18,095,503; expenses, $10,046,487; net, $8,049,016; other income, $196,577; total income, $8,245,593; taxes and license, $1,120,683; balance, $7,124,910; charges, $7,488,958; deficit, $364,048. This compares with a surplus of $303,997 for 1906. The number of passengers carried was 492,137,038. At the annual meeting the old directors were reelected.

Chicago:	*Closing.*
Chicago Telephone	107½
Chicago Edison Light	135
Metropolitan Elevated preferred	61
National Carbon common	72
National Carbon preferred	112

The directors of the Chicago Telephone Company have declared the regular quarterly dividend of 2¼ per cent, payable September 30.

Directors of the Metropolitan Elevated have declared a regular quarterly dividend of ¾ of 1 per cent on the preferred stock, payable September 30.

The Northwestern Elevated has issued its annual report for the year ended June 30, 1907. The income account is as follows: Gross, $2,100,315; expenses, $744,304; net, $1,356,011; charges, taxes, etc., $1,008,433; surplus, $347,578, as compared with a surplus of $280,499 for the preceding year. At the annual meeting of the Northwestern Elevated the old directors and officers were reelected.

The annual report of the South Side Elevated Railroad Company to the Railroad and Warehouse Commission of Illinois for the fiscal year ended June 30, 1907, has been issued. It shows income from all sources amounting to $1,854,049, which was a gain of $78,357 compared with the previous year. Operating expenses totaled $1,292,009 and were $173,507 in excess of the preceding year; thus net earnings of $562,040 were $95,150 less than the year before. The principal increases in the operating account are shown in the cost of conducting transportation and loop expenses, which were $144,587 in excess of the preceding year. The total expenses were 69.69 per cent of the company's entire revenues, compared with 62.98 per cent the year before. Interest charges were the same as the previous year and applied only on the original issue of bonds. The $8,700,000 of new bonds issued to cover the cost of the extensions are carried in a separate account. The balance of $528,290 after charges, which was the amount applicable to dividends, equaled 5.11 per cent on $10,323,800 capital stock outstanding.

OBITUARY NOTE.

MR. F. J. STOUT, general manager of the Lake Shore Electric Railway Company, died in the Toledo (Ohio) city hospital, Saturday afternoon, September 14. Death was due to an operation, which resulted in the development of uraemic poisoning. Mr. Stout was born in Deerfield, Mich., forty-nine years ago and commenced his career as a switchman on the Lake Shore steam road.

ELECTRIC RAILWAYS.

BOISE, IDA.—The Boise & Interurban Railway Company will double track its line as far as Pierce Park.

STOCKTON, CAL.—The Central California Traction Company's interurban system to Lodi has been completed and placed in operation.

QUINCY, ILL.—The city council has adopted an ordinance giving a franchise of fifty years' duration to the St. Louis, Terre Haute & Quincy Traction Road.

PORTLAND, ORE.—The directors of the Oregon Electric Railway Company have authorized the construction of a branch line from a point near Portland to Hillsboro.

TOLEDO, OHIO—A perpetual grant, permitting the Lima & Toledo Traction Company to cross certain Toledo streets, has been awarded to that company by the city council.

PITTSBURG, PA.—The Beaver Valley Traction Company has started service on its line between Beaver Falls and Leetsdale, thus bringing the line within fifteen miles of Pittsburg.

WAYNESBORO, PA.—The Chambersburg, Greencastle & Waynesboro Street Railway Company has been granted the right to extend its trolley line from Greencastle to Chambersburg.

SYRACUSE, N. Y.—The Syracuse, Lakeshore & Northern Electric Railway Company has filed the certificate of the railroad commissioners permitting the extension of the capitalization of the company from $2,250,000 to $3,500,000.

PHILADELPHIA, PA.—A new trolley road will be built from Minersville, the terminus of the present lower Schuylkill line, to Hegins and Millersburg, returning to Ashland by way of Gordon through Mabel. Work will be started at once.

ITHACA, N. Y.—The final transfer of the Ithaca Street Railway Company stock by E. G. Wyckoff and associates to A. H. Flint & Company, of New York, has been announced. The exact price was not made public, but it is said to be $250,000.

PROVIDENCE, R. I.—Plans are now being formulated by the Providence & Danielson Railway Company to run through cars to Putnam, Ct., and to improve its transportation facilities all along the line. D. F. Sherman, president of the road, states that most of the changes will be made at once.

DUNKIRK, N. Y.—Peter R. Colgan, of Dunkirk, and M. V. Ryan have been awarded the contract by the Western New York & Pennsylvania Traction Company for the excavation for a new trolley line between Little Valley and Salamanca, a distance of four miles, and work has been started.

MADISON, WIS.—A certificate of public convenience and necessity has been granted by the railroad rate commission to the Interstate Transfer Railroad Company, of Superior, which will operate a line from Superior to the vicinity of Duluth.

SALEM, ORE.—The Salem city council has passed an ordinance granting to A. Welch a franchise for an electric line through the city. The franchise requires that a $50,000 bond be given to assure the completion of two miles of road within eighteen months. The term of the franchise is twenty-five years.

BRISTOL, CT.—The contract has been let by the Bristol & Plainville Tramway Company for the immediate erection of an addition to its power plant in Highland court. The building will be forty-two feet by thirty feet, and two stories high. The additional space will be used for extra boiler power.

EVERETT, WASH.—Stone & Webster have taken formal possession of the properties recently purchased from the Everett Improvement Company. The Everett street railway lines have been leased by the Puget Sound International Railway Company, a corporation controlled by the Stone & Webster Company.

COLUMBUS, OHIO—The Northern Ohio Traction and Light Company, in which a number of local men are stockholders, announces that it will issue $1,000,000 treasury stock to present holders at the rate of $20 per share, the $200,000 so acquired to be used in the pushing of contemplated improvements. All the new issue not subscribed for will be taken over by an underwriting syndicate which has been formed for that purpose.

LISBON, OHIO—The Youngstown & Ohio River Railroad Company, which is building a traction line from Youngstown to East Liverpool, a distance of fifty-one miles, has established regular service from this city to Youngstown. Construction work is well advanced on the remainder of the line, from this city to East Liverpool.

HARTLEY, IOWA—The Sioux City & Spirit Lake Interurban has organized as follows: president, Frank Patch, president Hartley state bank; vice-president and attorney, J. T. Conn, president German savings bank; secretary, George Coleman; treasurer, G. E. Knaack; directors, Frank Patch, J. T. Conn, George Coleman, G. E. Knaack, Dr. D. A. Fletcher, H. D. Ellers.

VENTURA, CAL.—F. M. Packard, a real estate man of Los Angeles, and J. P. Jones, also of that city, have applied to the board of supervisors for a franchise to construct an electric railroad between this town and Nordhoff, sixteen miles north, in the beautiful Ojai Valley, a noted health resort. They say they have the money behind them to build the road.

CANANDAIGUA, N. Y.—At a meeting of the directors and stockholders of the Canandaigua Southern Electric Railway Company, held in Canandaigua, it was announced that plans are under way for the extending of the road from Atlanta to Wayland, and thence by way of the Pittsburg & Shawmut road to Hornell. If this plan is consummated the latter road will be electrified from Wayland to Hornell.

ST. LOUIS, MO.—The passage of two ordinances by the Venice city council granting a right of way to the McKinley interurban system completes the franchises for both the east and west approaches to the proposed McKinley Bridge across the Mississippi river to Venice. The company is now in a position to begin track-laying in St. Louis at any time. If the approaches are completed before the bridge, cars will be conveyed across the river on ferries.

SACRAMENTO, CAL.—The Northern Electric Railroad will extend its line north from Chico to Red Bluff, Redding and Kennett. This announcement has been made by Major Jones, one of the original promoters of the line. The company is engaged in perfecting its terminal in this city and in opening its eighteen-mile extension west from Chico to Hamilton City, in Glenn county. Following this, work will be started on the northern extension.

CHICAGO, ILL.—The Northwestern Elevated Railroad Company has received permission to proceed with the extension of its road from Graceland avenue to the city limits. The permit is the result of the passage of the ordinance granting the company the right to descend to the surface at Wilson avenue and run out to Evanston along the right of way of the Chicago, Milwaukee & St. Paul Railway. The cost of the extension, it is expected, will approximate $1,000,000.

LOUISVILLE, KY.—To secure the payment of notes aggregating $400,000, a mortgage has been filed in the office of George W. Stoner, recorder of Clark county, at Jeffersonville, from the Indianapolis & Louisville Traction Company to the Colonial Trust Company, of Pittsburg, Pa., and F. F. Brooks, trustee, against all the property owned by the mortgagee, including the rights, franchises and equipment so far purchased, subject to a deed of trust for $1,250,000 issued on April 1, 1906.

DOVER, N. H.—The New Hampshire state railroad commissioners have voted to authorize the Hudson, Pelham & Salem Street Railway Company to issue new stock to the amount of $200,000 for the purchase of the property of the Hudson, Pelham & Salem Electric Railway. The Hudson, Pelham & Salem electric line was practically forced into insolvency owing to a serious collision on the road to Pelham a few years ago, and was disposed of to the new corporation.

NORWICH, CT.—The incorporators of the Norwich, Colchester & Hartford Traction Company have organized with Costello Lippitt as president, Lucien Brown, secretary, and Henry W. Tibbets, treasurer. All the officers are residents of Norwich. The company, which has a charter to construct a street railway between Norwich and Hartford, has a capital stock of $1,000,000. The route runs through various villages which are now isolated from trolley accommodations, and the length of the proposed line is thirty-eight

miles, which is shorter by eleven miles than the present steam line.

BINGHAMTON, N. Y.—Two trolley roads planning to make a continuous line from Binghamton to Utica have been granted franchises through the village of Norwich. One of the concerns, the Chenango Valley Company, proposes to build from Binghamton to Norwich and from that village up the Canaswacta and Otselic valleys to South Otselic and from that place to Hamilton. The Utica Southern is planning to build from Utica to Norwich and to extend the line to Binghamton. The terms of the franchise granted to both roads are the same, owing to the fact that both roads are to cover different sections of the country except where they enter the village of Norwich.

AUGUSTA, ME.—The permanent organization of the Lewiston, Augusta & Waterville Electric Railway Company has been effected. The officers are: president, John R. Graham, Bangor; vice-president, H. L. Clark, Philadelphia; treasurer, D. S. Hahn, Lewiston; clerk, Herbert M. Heath, Augusta. Directors: John R. Graham, Bangor; John F. Hill, Thomas J. Lynch, Augusta; W. H. Newall, Lewiston; H. L. Clark, C. A. Pierson, Jr., Philadelphia; Frank Silliman, Scranton, Pa. This is the merger company which was authorized by the recent legislature to acquire street railroad properties in the counties of Androscoggin, Kennebec, Somerset, Waldo, Knox, Lincoln and Sagadahoc. It has acquired the Lewiston, Brunswick & Bath, with fifty-eight miles of line in Auburn, Lewiston, Lisbon, Topsham, Brunswick, West Bath, Bath and Webster in Androscoggin, Cumberland and Sagadahoc counties; and the Augusta, Hallowell, Farmingdale, Manchester, Winthrop and Gardiner in Kennebec county. The road in Cumberland county is building thirty-three miles of line *via* Webster and Wales in Androscoggin county, and Monmouth, Litchfield, West Gardiner and Gardiner in Kennebec county, and twenty-four miles to connect Augusta with Vassalboro, Winslow and Waterville.

TELEPHONE AND TELEGRAPH.

JUNEAU, ALASKA—The Juneau-Douglas Telephone Company has made application for a telephone franchise in Juneau.

HAWARDEN, IOWA—The New State Telephone Company will build a toll line from here to Ireton, Orange City, Granville and other towns.

NEWBURYPORT, MASS.—The New England Telephone and Telegraph Company has begun the work of erecting a trunk line on Ring's Island.

ATHENS, ALA.—Athens is about to secure telephone connection with Elkmont and Pettusville, two important villages in the north part of the county.

LITTLE ROCK, ARK.—The Waldron Telephone Company has installed an exchange at Bates, giving free service from there to Waldron, Heavener, Wicks, Morgan and all intermediate points.

DALLAS, TEX.—B. H. Johnston, superintendent of construction of the Southwestern Telephone Company, has gone to Little Rock to look after extensions of the company's lines in the state of Arkansas.

WASHINGTON, D. C.—Plans have been perfected and the material ordered for wireless installations at the signal corps post at Fort Omaha, Neb., at the service schools at Fort Leavenworth, Kan., and at Fort Riley, Kan.

JEFFERSONVILLE, IND.—The Home Telephone Company has filed a petition with the board of works for a franchise to operate an exchange here, agreeing not to combine with or sell out to the Cumberland Telephone Company if the charter is granted.

WILLOWS, CAL.—C. L. Schaad, president of the Colusa County Telephone Company, and Jack Campbell, a director of the company, have been arranging for the commencement of work by that company in erecting poles and stringing wires for the purpose of maintaining a telephone line in Glenn county. It is the intention of the company to commence work at once, and as it has already secured a franchise from the county there will be nothing to prevent it entering Butte City, Hamilton City, St. John, Orland, Germantown, Newville, Elk Creek, Fruto and other smaller towns in the near future.

INDUSTRIAL ITEMS.

THE EDGECOMBE COMPANY, Cuyahoga Falls, Ohio, has entered the electrical contracting field, and is desirous of receiving copies of catalogues of electrical supplies.

THE WATSON-STILLMAN COMPANY, New York city, has published a catalogue devoted to its turbine pumps. All of the reading matter found in this catalogue is practically new. The catalogue will be sent to any one interested upon request.

THE HOLOPHANE COMPANY, 227 Fulton street, New York city, has published the September issue of "Holophane," devoted to the Holophane system of illumination. An interesting article describes the lighting of a chain of cigar stores, showing a number of illustrations. In addition to this there are a number of very interesting articles devoted to important phases of illuminating engineering.

THE FORT WAYNE ELECTRIC WORKS, Fort Wayne, Ind., has published bulletins No. 1098 and No. 1100, describing and illustrating, respectively, type MPL belted generators for light and power, and small direct-current motors, type L. There is also a supplement to instruction books 3004, 3015 and 3028, and instruction book 3028, devoted to type K single-phase integrating induction wattmeters.

THE ANSONIA BRASS AND COPPER COMPANY, 99 John street, New York city, has issued a new catalogue describing its "Tobin bronze" products. This catalogue includes a dissertation on acid tests, crushing strength, instructions for ordering and manipulation, specific gravity, torsional strength, transverse strength of bars, tensile strength of plates and rods, weight of a cubic inch, weight of rods and plates. This catalogue will be sent to any one interested upon request.

THE CHASE-SHAWMUT COMPANY, Newburyport, Mass., has ready for distribution a new series of literature devoted to "Shawmut" enclosed fuses, cutouts and fittings; the "Shawmut" pocket test lamp; "Shawmut" all-copper ground connection clamps; "Shawmut" extended terminal enclosed fuses; "Shawmut" outlet blocks and outlet bushings and locknuts, porcelain cutouts, "Red E" solder paste, and the "Boston" cable clip. Any of this literature will be sent to those interested upon request.

THE SPRAGUE ELECTRIC COMPANY, 527 West Thirty-fourth street, New York city, has published some very attractive literature as follows: Bulletin No. 108, devoted to electric dynamometers for testing gasolene engines; bulletin No. 230, the electric equipment of a modern factory; bulletin No. 231, devoted to direct-current motor equipment for single or double-acting Mergenthaler linotype machines. Another handsome catalogue is devoted to electric motor equipments for printing, electrotyping, stereotyping and binding machinery. All of this literature is very much above the ordinary, and forms a valuable addition to the subject matter which is discussed.

THE GENERAL ELECTRIC COMPANY, Schenectady, N. Y., has published a handsome bulletin, No. 4,523, devoted to electric heating and cooking devices for marine use. The bulletin contains illustrated descriptions of small apparatus particularly useful in ships' galleys, staterooms, smoking-rooms, sick bays, etc. The electrical devices made by the General Electric Company are particularly adaptable for this service. Two distinct forms of heating elements are used by the company, known, respectively, as the cartridge and quartz enamel units. Both heating units are practically indestructible, but can be readily replaced if damaged by accident.

THE ELECTRIC CITY PUBLISHING COMPANY, Chicago, Ill., announces that, owing to a steady growth necessitating larger office space, the company has moved its offices from the Edison Building, 139 Adams street, to the Electric Block, 84-88 Market street, where the entire second floor of the new building has been equipped for the publication offices of the company. *The Electric City* is devoted to the electric lighting and power installations of Chicago and its suburbs. It supplies its readers with information and data regarding electrical inventions and conveniences from all over the world. Herbert Alden Seymour is editor, and Dana H. Howard business manager.

Record of Electrical Patents.

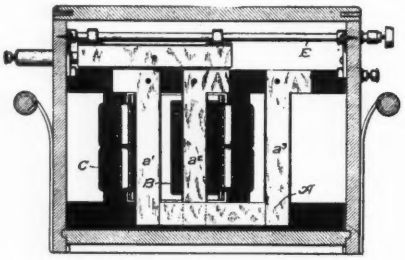
Week of September 17.

865,985. VARIABLE-VOLTAGE TRANSFORMER. Thomas M. Bains, Jr., Philadelphia, Pa., assignor to General Electric Company. A three-legged core with a primary winding on the central leg and secondary winding about the central and one outside leg.

865,988. ELECTRIC LOCOMOTIVE. Asa F. Batchelder, Schenectady, N. Y., assignor to General Electric Company. The locomotive frame forms part of the magnetic circuit.

865,997. ELECTROMAGNETIC VARIABLE-SPEED MECHANISM. Alexander Churchward, New York, N. Y., assignor to General Electric Company. A combination of a variable-speed mechanism with magnetic clutches.

866,011. METHOD OF IMPROVING VAPOR ELECTRIC DEVICES. Samuel Ferguson, Schenectady, N. Y., assignor to General Electric Company. A low-voltage current is employed for distilling mercury from the anodes.



865,985.—VARIABLE-VOLTAGE TRANSFORMER.

866,036. TELEPHONE MOUTHPIECE. Rudolf Knoll, Vienna, Austria-Hungary. A bent rotatable mouthpiece.

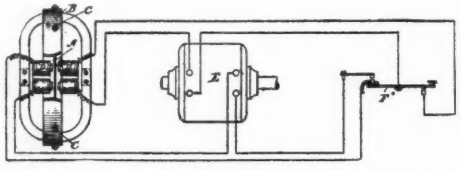
866,081. CONTROL OF SEPARATELY EXCITED GENERATORS. Georg Stern, Berlin, Germany, assignor to General Electric Company. A variable exciting current is supplied from an external source.

866,089. COMBINED LAMP SOCKET AND SHADE HOLDER. Julius C. Tournier, Schenectady, N. Y., assignor to General Electric Company. A sheet metal socket.

866,090. FUSE BOX. Lewis E. Troutman, Schenectady, N. Y., assignor to General Electric Company. A recessed fuse block.

866,105. FLUSH RECEPTACLE AND PLUG. George P. Whittlesey, Washington, D. C., assignor to General Electric Company. A receptacle with circular shutter.

866,128. DEVICE FOR TRANSMITTING SOUND THROUGH WATER. Elisha Gray, Highland Park, Ill., assignor, by mesne assignments, to Submarine Signal Company. A sounding plate vibrated electromagnetically.



866,128.—DEVICE FOR TRANSMITTING SOUND THROUGH WATER.

866,138. TELEPHONE SYSTEM. Henry F. Joeckel, Clayton, Ill. A system employing bridging telephones.

866,193. TROLLEY GUIDE. Frank G. Clark, San Francisco, Cal. A fork attached to the trolley pole.

866,212. CURRENT-DISTRIBUTOR FOR SPARKING DEVICES. Montague S. Napier, London, England. A rotating contact maker.

866,224. TROLLEY POLE. Alexander Ross. Rochester, N. Y. A telescoping pole.

866,241. IGNITION SYSTEM FOR EXPLOSION ENGINES. Richard Varley, Englewood, N. J., assignor to the Autocoil Company. An auxiliary generator is used for starting.

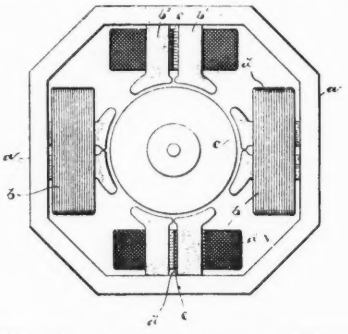
866,261. RAILWAY TRAFFIC-CONTROLLING SYSTEM. Clarence W. Coleman, Westfield, N. J., assignor to the Hall Signal Company. An electric signaling system.

866,266. TELEPHONE SYSTEM. William W. Dean, Chicago, Ill., assignor to Kellogg Switchboard and Supply Company, Chicago, Ill. A central-energy system.

866,281. RAILWAY SIGNAL. William H. Jordan, Brooklyn, N. Y., and George T. Hanchett, Hackensack, N. J., assignors to Jordan Automatic Signal Company, New York, N. Y. An electromagnetic signal.

866,286. ELECTRIC GENERATOR AND MOTOR. Alvaro S. Krotz, Springfield, Ohio, assignor of one-half to Paul A. Staley, Springfield, Ohio. A field magnet with split poles, one section of the poles being wound with an extra coil.

866,301. METHOD OF FORMING SEALS AND TERMINALS FOR ELECTRIC APPARATUS. Henry N. Potter, New Rochelle, N. Y., assignor to Cooper Hewitt Electric Company, New York, N. Y. Metallic silicon is fused within quartz glass.



866,286.—ELECTRIC GENERATOR AND MOTOR.

866,311. ELECTROPLATING APPARATUS. Albert F. Schroeder, Cleveland, Ohio. A rotating holder.

866,327. AUTOMATIC TIME-CALL. Jesse E. Boone, Almedia, Pa. A signaling clock.

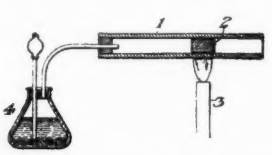
866,331. RAILWAY SIGNAL. Frederic B. Camors and Charles Pelletier, New Orleans, La A system for signaling on moving cars.

866,349. TROLLEY-POLE SUPPORT. Hugh W. Fellows, Cahuenga, and Ira A. Cammett, Hollywood, Cal. A pivoted support for trolley poles.

866,363. TROLLEY WHEEL. Henry L. Humphrey, Monroe, Mich. A spherically mounted wheel.

866,471. ELECTRIC BELL. Robert L. Hunter, Lakewood, Ohio, assignor of one-half to Don M. Osborne, Cleveland, Ohio. A bell of solenoid construction.

866,521. AUTOMATIC SAFETY APPARATUS FOR RAILWAYS. George E. Ryan, New York, N. Y. A signal operated by a trip placed in the path of the car.



866,301.—METHOD OF FORMING SEALS AND TERMINALS FOR ELECTRIC APPARATUS.

866,550. AUTOMATIC GAS VALVE. Michael Wlaat, New York, N. Y. An electrically controlled valve.

866,556. LIGHTNING ARRESTER. Azel Ames, Jr., New York, N. Y., assignor of one-half to Asbury G. Wilson, Wilkinsburg, Pa. A ground terminal is placed within a coil of wire.

866,577. TELEPHONE-RECEIVER HOLDER. Arlington D. Brittain, Youngstown, Ohio. A horizontal support for the receiver.

866,590. ELECTRICAL SWITCH. Michael J. Kehoe, Fort Wayne, Ind., assignor of one-third to Benjamin Lehman, Fort Wayne, Ind. A pole switch.

866,596. INSULATOR. William A. Morton, Los Angeles, Cal. A slotted insulator.

866,597. PROCESS OF PRODUCING MANGANESE SILICID. Edgar F. Price, Niagara Falls, N. Y., assignor to Electro Metallurgical Company. An electric furnace process.